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IN THE UNITED STATES PATENT
AND TRADEMARK OFFICE

Group Art Unit 3616
Examiner Laura Beth Freedman

Eduardo L. Quioc et al. **APPEAL BRIEF**

Application Serial No. 10/826,437

Filed April 16, 2004

For: BELT AND SIDE IMPACT INFLATOR April 16, 2007

Sir:

This is an appeal from the final rejection of claims 1-7 and 9-34 set forth in the office action mailed on October 16, 2006.

Table Of Contents

(i) Real Party In Interest

The real party in interest in this appeal is Automotive Systems Laboratory, Inc., a Delaware corporation, the owner of the subject application by assignment.

(ii) Related Appeals And Interferences

There are presently no other appeals and/or interferences known to appellant, appellant's legal representative, or assignee which will directly affect or be directly affected by the Board's decision in the pending appeal.

(iii) Status Of Claims

Claims 1-7 and 9-34 are pending and stand finally rejected in an Office Action mailed on October 16, 2006 (Paper # 20061004). The rejections of claims 1-7 and 9-34 are appealed herein.

(iv) Status Of Amendments

In an Advisory Action (Paper No. 20070223), mailed February 27, 2007, the Examiner indicated that the amendments set forth in Applicants' 37 CFR § 1.116 response, filed February 15, 2007, would be entered for appeal purposes.

(v) Summary of Claimed Subject Matter

INDEPENDENT CLAIM 1

In one aspect of the present invention, an inflator 10 (page 3, lines 18-20; FIG. 2) is provided including an inflator body 12 (page 3, lines 19-20; FIG. 2) and a substantially cylindrical booster cup 22 (page 3, lines 32-34, continuing through page 4, lines 1-2; FIG. 2) extending in the body 12. The booster cup 22 has an outer peripheral wall 27 (page 4, lines 9-11; FIG. 2) and an end surface 29 (page 3, line 34, continuing through page 4, lines 1-2; FIG. 2) extending radially inwardly from the wall 27. A plurality of apertures 24 (page 4, lines 6-7; FIG. 2) is formed in the booster cup outer peripheral wall 27. A first propellant charge 18 (page 4, lines 2-3; FIG. 2) is positioned in the booster cup 22. A second propellant charge 28 (page 4, lines 22-24; FIG. 2) is positioned in the inflator body 12. The inflator 10 also includes an initiator assembly 14 (page 3, lines 20-22; FIG. 2) operable to activate the first propellant charge 18, wherein a combustion thereof initiates a combustion of the second propellant charge 28 and ejection of an inflation gas from the inflator body 12. A filter 38 (page 4, lines 27-34, continuing through page 5, lines 1-4; FIG. 2) is provided abutting the booster cup end surface 29. A perforated disc 30 (page 5, lines 4-7; FIG. 2) abuts the filter 38, and a nozzle 36 (page 5, lines 7-14; FIG. 2) is positioned at an end of the inflator 10 and abuts the perforated disc 30 for supplying an inflation gas to an inflatable restraint system.

INDEPENDENT CLAIM 7

In another aspect of the present invention, an inflator 10 (page 3, lines 18-20; FIG. 2) is provided for an inflatable restraint system in a vehicle. The inflator 10 includes an inflator body 12 (page 3, lines 19-20; FIG. 2) having first and second ends 11, 13 and an inner peripheral wall 25 (page 4, lines 9-11; FIG. 2), and a booster cup 22 (page 3, lines 32-34, continuing through page 4, lines 1-2; FIG. 2) extending in the body 12. The booster cup 22 has an outer peripheral wall 27 (page 4, lines 9-11; FIG. 2) and an end surface 29 (page 3, line 34, continuing through page 4, lines 1-2; FIG. 2) extending inwardly from the outer peripheral wall 27. The booster cup 22 has a first propellant charge 18 (page 4, lines 2-3; FIG. 2) positioned therein. The inner peripheral wall 25 and the outer peripheral wall 27 are separated by a substantially annular space 26 (page 4, lines 9-11; FIG. 2) having a second propellant charge 28 (page 4, lines 22-24; FIG. 2) positioned therein. An initiator assembly 14 (page 3, lines 20-22; FIG. 2) is disposed proximate the initiator body first end 11 and is operable to ignite the first propellant charge18. A filter 38 (page 4, lines 27-34, continuing through page 5, lines 1-4; FIG. 2) abuts the booster cup end surface 29. A perforated disc 30 (page 5, lines 4-7; FIG. 2) abuts the filter 38, and a nozzle 36 (page 5, lines 7-14; FIG. 2) is positioned at the second end 13 of the inflator body 12 and abuts the perforated disc 30. The nozzle 36 defines a nozzle outlet (page 5, lines 11-12, lines 19-32; FIG. 2) for supplying an inflation gas to the inflatable restraint system.

INDEPENDENT CLAIM 14

In yet another aspect of the present invention, an inflatable restraint system 100 (page 6, lines 28-29; FIG. 3) for a motor vehicle is provided. The inflatable restraint system 100 includes an inflatable restraint device 170 (page 6, line 34, continuing through to page 7, line 1; FIG. 3) and an inflator 110 (page 6, lines 29-30; FIG. 3; also page 3, lines 18-20; FIG. 2) operable to provide an inflation gas to the inflatable restraint device 170. The inflator 10 includes an elongate substantially cylindrical inflator body 12 (page 3, lines 19-20; FIG. 2) having first and second ends 11, 13, and an inner peripheral wall 25 (page 4, lines 9-11; FIG. 2). An elongate booster cup 22 (page 3, lines 32-34, continuing through page 4, lines 1-2; FIG. 2) is mounted to the inflator body 12 proximate the body first end 11 and extends substantially coaxially therewith. The booster cup 22 has an outer peripheral wall 27 (page 4, lines 9-11; FIG. 2) separated from the inner peripheral wall 25 by an annular space 26 (page 4, lines 9-11; FIG. 2). A plurality of apertures 24 (page 4, lines 6-7; FIG. 2) is formed in the booster cup outer peripheral wall 27 (page 4, lines 9-11; FIG. 2). A propellant charge 28 (page 4, lines 22-24; FIG. 2) is positioned in the annular space 26. A filter 38 (page 4, lines 27-34, continuing through page 5, lines 1-4; FIG. 2) is positioned in the inflator body 12 abutting an end portion of the booster cup 22. The filter 38 secures the propellant charge 28 in the annular space 26. A perforated disc 30 (page 5, lines 4-7; FIG. 2) abuts the filter 38, and a nozzle member 36 (page 5, lines 7-14; FIG. 2) is positioned proximate the second end 13 of the inflator body 12 and abuts the perforated disc 30. The nozzle member 36 constrains the filter 38 against axial displacement.

INDEPENDENT CLAIM 23

In yet another aspect of the present invention, an inflatable airbelt system 200 (page 7, lines 14-20; FIG. 2) for a motor vehicle is provided. The airbelt system 200 includes an inflatable airbelt 250 (page 7, lines 14-20; FIG. 2) and an inflator 10 (page 3, lines 18-20; FIG. 2) operable to provide an inflation gas to the airbelt. The inflator 10 includes an inflator body 12 (page 3, lines 19-20; FIG. 2) and a booster cup 22 (page 3, lines 32-34, continuing through page 4, lines 1-2; FIG. 2) extending in the body 12. The booster cup 22 has an outer peripheral wall 27 (page 4, lines 9-11; FIG. 2) and an end surface 29 (page 3, line 34, continuing through page 4, lines 1-2; FIG. 2) extending radially inwardly from the wall 27. The booster cup 22 also includes a plurality of apertures 24 (page 4, lines 6-7; FIG. 2) formed in the outer peripheral wall 27. A first propellant charge 18 (page 4, lines 2-3; FIG. 2) is positioned in the booster cup 22. A second propellant charge 28 (page 4, lines 22-24; FIG. 2) is also positioned in the inflator body 12. The inflator 10 also includes an initiator assembly 14 (page 3, lines 20-22; FIG. 2) operable to activate the first propellant charge 18, wherein a combustion thereof initiates a combustion of the second propellant charge 28 via the apertures 24 in the booster cup peripheral wall 27. A filter 38 (page 4, lines 27-34, continuing through page 5, lines 1-4; FIG. 2) abuts the booster cup end surface 29, and a perforated disc 30 (page 5, lines 4-7; FIG. 2) abuts the filter 38. A nozzle 36 (page 5, lines 7-14; FIG. 2) is

positioned at an end of the inflator 10 and abuts the perforated disc 30 for supplying an inflation gas to the inflatable restraint airbelt system 200.

INDEPENDENT CLAIM 27

In yet another aspect of the present invention, an inflator module 160 (page 6, lines 29-31; FIG. 3) for a vehicle occupant protection system is provided. The inflator module 160 includes a module housing and an inflator 110 (page 6, line 30; FIG. 3; also page 3, lines 18-20; FIG. 2) positioned in the module housing. The inflator 10 includes a booster cup 22 (page 3, lines 32-34, continuing through page 4, lines 1-2; FIG. 2) mounted to an inflator body 12 (page 3, lines 19-20; FIG. 2). The booster cup 22 extends substantially coaxially with the inflator body 12. The booster cup 22 has an outer peripheral wall 27 (page 4, lines 9-11; FIG. 2) partially defining an annular space 26 (page 4, lines 9-11; FIG. 2), and a plurality of apertures 24 (page 4, lines 6-7; FIG. 2) formed in the outer peripheral wall 27. A propellant charge 28 (page 4, lines 22-24; FIG. 2) is positioned in the annular space 26. A filter 38 (page 4, lines 27-34, continuing through page 5, lines 1-4; FIG. 2) is positioned in the inflator 10 abutting an end portion of the booster cup 22 for securing the propellant charge 28 in the annular space 26. A perforated disc 30 (page 5, lines 4-7; FIG. 2) abuts the filter 38, and a nozzle 36 (page 5, lines 7-14; FIG. 2) is positioned at an end of the inflator 10. The nozzle 36 abuts the perforated disc 30 for supplying an inflation gas to the inflatable restraint of the vehicle occupant protection system.

INDEPENDENT CLAIM 30

In yet another aspect of the present invention, a method of manufacturing a gas generator 10 is provided. The method includes the steps of positioning a booster cup 22 (page 3, lines 32-34, continuing through page 4, lines 1-2; FIG. 2) within an elongate substantially cylindrical inflator body 12 (page 3, lines 19-20; FIG. 2); placing a propellant charge 28 (page 4, lines 22-24; FIG. 2) in a space 26 extending between an outer peripheral wall 27 (page 4, lines 9-11; FIG. 2) of the booster cup 22 and an inner peripheral wall 25 (page 4, lines 9-11; FIG. 2) of the inflator body 12; inserting a filter member 38 (page 4, lines 27-34, continuing through page 5, lines 1-4; FIG. 2) into the inflator body 12 up to a point at which the filter 38 bears against an end surface of the booster cup 22; positioning a perforated disc 30 (page 5, lines 4-7; FIG. 2) abutting the filter 38; and positioning a nozzle member 36 (page 5, lines 7-14; FIG. 2) in the inflator body 12 at a selected axial position and abutting the perforated disc 30 such that the filter 38 is constrained from axial movement between the nozzle member 36 and the booster cup 22, whereby the filter 38 secures the propellant charge 28 in the space 26.

(vi) Grounds Of Rejection To Be Reviewed On Appeal

Whether claims 1-7, 9-21, and 27-34 are anticipated under 35 U.S.C. 102(b) by Kirchoff et al., U.S. Patent No. 3,972,545.

Whether claims 14 and 22-26 are unpatentable under 35 U.S.C. 103(a) in view of Schneider et al., U.S. Patent No. 6,279,945, and in view of Kirchoff et al. '545.

(vii) Argument

A. Rejection Under 35 U.S.C. §102(b) Over Kirchoff et al., U.S. Patent No. 3,972,545

In pages 3-5 of the final Office Action, the Examiner states:

"4. Claims 1-7, 9-21, and 27-34 are rejected under 35 U.S.C. 102(b) as being anticipated by Kirchoff et al. (3,972,545). Kirchoff et al. disclose an inflator (including #5) able to be used with an inflatable restraint system (for example, an airbag), comprising:

- Inflator body (including #6) having a first end (for example, left end in figure 1) and a second end (for example, right end in figure 1)
- Elongate, substantially cylindrical booster cup (including #34) extending in the body, oriented substantially coaxially with the inflator body, and having an outer peripheral wall (for example, outer cylindrical wall) and an end surface (for example, right end in figure 1) extending radially inwardly from the wall
- Plurality of apertures formed in the outer peripheral wall (apertures formed when peripheral wall of tube is ruptured by squib and pyrotechnic material)
- First propellant charge (including #21) positioned in the booster cup
- Second propellant charge (including #18) positioned in the inflator body
- Initiator assembly (including squibs #19, 20) able to activate the first propellant charge, a combustion thereof initiating a combustion of the second propellant charge and ejection of an inflation gas from the inflator body (via discharge orifice #13)
- Inflator body comprises an inner peripheral wall separated from the outer peripheral wall by a substantially annular space, the second propellant charge being positioned in the space, substantially adjacent the outer peripheral wall (best seen in figure 1)

- Second propellant charge comprise a plurality of propellant tablets (including #18) and substantially fills the space between the outer peripheral wall and the inner peripheral wall of the inflator body (best seen in figure 1)
- Filter (including #22, 24, 28, 29, 30, 32) constraining the second propellant charge in the space (best seen in figure 1)
- Nozzle (including #12) positioned at the second end of the body and defining a nozzle outlet (including #13) able to supply an inflation gas to the inflatable restraint system
- Filter abutting the booster cup end surface (in particular, filter component #22)
- Body has a total length and an area defined by a cross-section, and the filter has a given length about one-half (though not necessarily drawn to scale, filter appears to be about one-half of the total length of the body, as seen in figure 1), the filter occupying a volume determined by multiplying the cross-section of the body by the length of the filter
- Substantially annular space separating inner peripheral wall and outer peripheral wall extends longitudinally in the inflator body from a point proximate the first end up to a point substantially coplanar with the end surface of the booster cup (best seen in figure 1)
- Nozzle constrains the filter against axial displacement (for example, via contact of right end of filter with left end of nozzle including perforated annulus #33, as seen in figure 1)
- Tablets (including #18) positioned in a geometrically ordered fashion in the annular space (for example, as seen in figure 1)
- Tablets (including #18) stacked adjacently in the annular space and having cylindrical axes oriented substantially perpendicular the inner peripheral wall (for example, as seen in figure 1)
- Booster cup attached to initiator body (including plug at left end of squib #19 that is attached to end cap #7) and suspended therefrom, being supported in the inflator body solely by the attachment to the initiator body (best seen in figure 1)
- Filter is substantially cylindrical and includes a substantially cylindrical periphery

positioned adjacent the inner peripheral wall (best seen in figure 1) and a substantially planar end (for example, left end of filter portion #22) positioned flush with the end surface (right end of booster cup)

- Nozzle is threadingly engaged with the inflator body (at screw threads #11)
- Filter length is sized to change the gas pressure resulting form activation of the gas generator (for example, column 4, lines 9-16)
- Perforated disk (for example, including #31, 33) abutting the filter (for example, abutting right end of filter in figure 1)
- Nozzle (including #12) abutting perforated disc (best seen in figure 1)"

35 U.S.C. 102(b) states:

"A person shall be entitled to a patent unless —
...(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of the application for patent in the United States, ..."

CLAIM 1

Claim 1 recites:

"1. An inflator comprising:
an inflator body;
a substantially cylindrical booster cup extending in said body, said booster cup having an outer peripheral wall and an end surface extending radially inwardly from said wall;
a plurality of apertures formed in said outer peripheral wall;
a first propellant charge positioned in said booster cup;
a second propellant charge positioned in said inflator body;
an initiator assembly operable to activate said first propellant charge, wherein a combustion thereof initiates a combustion of said second propellant charge and ejection of an inflation gas from said inflator body;
a filter abutting said booster cup end surface;
a perforated disc abutting said filter; and
a nozzle positioned at an end of said inflator and abutting said perforated disc for supplying an inflation gas to an inflatable restraint system. "

The Examiner's attention is directed to MPEP § 2131, which states, in part:

"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987)."

MPEP § 2131 also states:

" 'The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989)."

Applicants believe that claim 1 is not anticipated by Kirchoff et al. '545 because the reference does not disclose all of the elements recited in the claim.

A) Kirchoff et al. '545 does not teach an inflator including *both* "a plurality of apertures formed in said outer peripheral wall," and "an initiator assembly operable to activate said first propellant charge" as recited in claim 1 of the present application.

There is no teaching or suggestion in Kirchoff et al. '545 that either squib 19 or squib 20 would rupture tube 34 so as to produce "a plurality of apertures" in the wall of tube 34. As is known in the art, in the absence of features (such as scoring, notches, or the like) designed to promote failure of the tube wall at predetermined points, the location (or locations) at which the tube ruptures will be determined by such factors as the locations along the length of the tube at which the tube is externally supported, the presence and locations of any inherent material weaknesses or structural weaknesses in the tube wall, the strength of any seals or connections between the tube and other portions of the gas generator interior, and the pressure distribution within the tube. Kirchoff et al. '545 discloses no inherent structural or surface features that would provide one or more predetermined failure points in tube 34.

The only indication of desired failure points along tube 34 is provided by the positioning of squibs 19 and 20 within the tube. As stated in column 2, lines 66-68, continuing through to column 3, line 1 of the reference:

> "Each chamber 16 and 17 is further equipped with an electric squib 19 and 20, respectively, surrounded by a pyrotechnic material 21."

The only portion of the reference that *explicitly* discusses the rupturing of tube 34 is found in column 3, lines 54-63, continuing through to column 4, line 1:

> "Hence, in the event that a collision is of the low level type, wherein only the downstream squib 20 is ignited by an electric signal, the heat from the burning gas generant 18 in the downstream chamber 17 will be rapidly transmitted through the wall of the tube 34 to ignite the pyrotechnic material 21 that is associated with the upstream squib 19. The squib 19 and its pyrotechnic material 21 will then rupture the wall of the tube 34 to ignite the gas generant material 18 in the upstream chamber 16. This causes a somewhat slower delivery of gases to an inflatable structure than in the case of a high-level impact wherein both squibs are fired simultaneously."

Thus, each of squibs 19 and 20 is positioned to ignite an associated gas generant positioned in one of chambers 16 and 17. That is, squib 19 is positioned to ignite the gas generant in chamber 16 when activated, and squib 20 is positioned to ignite the gas generant in chamber 17 when activated.

In order to ignite the gas generant in chamber 17, activation of squib 20 produces a localized pressure surge in the portion of the tube proximate the squib, causing tube 34 to rupture in the vicinity of squib 20, so that the resulting combustion products exit tube 34 and ignite gas generant 18 positioned in chamber 17. Similarly, in order to ignite the gas generant in chamber 16, activation of squib 19 causes tube 34 to rupture in the vicinity of squib 19, so that the resulting combustion products would exit tube 34 and ignite gas generant 18 positioned in chamber 16. Thus, the only express or implied disclosure relating to the rupture of tube 34 relates to the

positions or regions along the length of the tube where the tube ruptures, and not to whether "a plurality of apertures" are formed in any particular rupture region. Therefore, the only point in time at which the reference even implies that tube 34 has a *plurality* of ruptures formed therein is after *both* of squibs 19 and 20 have been activated, thereby producing a rupture proximate each of squibs 19 and 20. However, at this point in time, the gas generator described in Kirchoff et al. '545 does not include "...an initiator assembly operable to activate said first propellant charge.." because, at this point in time, both squibs have been fired and neither squib is operable to activate anything.

In view of the above, the disclosure of Kirchoff et al. '545 does not teach an inflator including ***both*** "a plurality of apertures formed in said outer peripheral wall," and "an initiator assembly operable to activate said first propellant charge" as recited in claim 1 of the present application.

In contrast, claim 1 of the present application affirmatively recites "a plurality of apertures formed in said outer peripheral wall" of the booster cup. The "plurality of apertures" exists in the wall of the booster cup *simultaneously with* "...an initiator assembly *operable to activate* said first propellant charge..." Furthermore, the *simultaneous existence* in the inflator of the present invention of "a plurality of apertures formed in said outer peripheral wall and "an initiator assembly operable to activate said first propellant charge" is explicit, or at the very least inherent, in the language of claim 1.

The inflator of the present invention provides important advantages over the device disclosed in Kirchoff et al. '545. The dimensions of the pre-formed apertures in the booster cup of the present invention are predetermined and permanent, facilitating more predictable flow of combustion products from the booster cup and combustion of the gas generant. This provides an inherently safer design. The pre-existing apertures formed in the booster cup also facilitate more rapid ignition of the gas generant; there is no delay in the transfer of combustion products from the booster cup to the gas generant due to the need to rupture the tube to create apertures.

B) Kirchoff et al. '545 also does not teach an inflator including a single filter which abuts *both* a booster cup end surface *and* a perforated disc which, in turn, abuts a nozzle "positioned at an end of said inflator... for supplying an inflation gas to an inflatable restraint system " as set forth in claim 1.

In paper No. 20070122, the Examiner states:

> "Further, Kirchoff et al. disclose a filter (including #22, 24, 28, 29, 30, 32) abutting the booster cup end surface (in particular, filter component #22 abutting right end of booster cup), a perforated disc (including #31, 33) abutting the filter (abutting right end of filter), and a nozzle (including #12) positioned at an end of the inflator and abutting the perforated disc (best seen in figure) and able to supply an inflation gas to an inflatable restraint system, as set forth in the final office action. Based on applicant's arguments, it appears that applicant does not consider a filter to be a feature that can include multiple components. However, in the Kirchoff et al. reference, the filter does indeed include multiple components (including #22, 24, 28, 29, 30, 32)."

The Examiner's point that a filter can include multiple components is well-taken. However, Applicants believe that the gas generator of Kirchoff et al. '545 incorporates *two separated* filter assemblies, rather than a *single* filter as disclosed in the present invention. In the reference, filtering screens 22 and coarse screen 24 combine to form a first filter assembly, and cooling means 29 and 30 combine to form a second filter assembly. As stated in column 3, lines 9-28 of the reference:

> "A plurality of layers of filtering screens 22, comprising relatively fine wire screen (about 30 to 60 mesh) is adjacent the end of the container 14 and is retained in place by a first perforated plate 23 having the same diameter as the inside of the housing 6. A spacing means consisting of a plurality of layers of coarse screen 24 (about 8 to 16 mesh) separates the filtering screens 22 from the perforated plate 23 to provide a free-flow volume of space for gases that may emerge from the container 14 when the gas generant material 18 is fired. *A plastic-film bag 25, containing a pH neutralizing material 26 is retained in a position adjacent the first perforated plate 23 by a second perforated plate 27. A preferred pH neutralizing material 26 is powdered iron sulfate, Fe.sub.2 $(SO_4)_3$ or $FeSO_4$.* A cooling means 28 is made in two sections, the first section 29 comprises a plurality of layers of coarse wire screen similar to the spacing means 24, and the second section 30 comprising a plurality of layers of fine wire screen similar to the filtering screens 22." (emphasis added)

Thus, the two filter assemblies described above are separated by a plastic-film bag 25 containing a pH neutralizing material 26 and retained in a position adjacent a first perforated plate 23 by a second perforated plate 27. This neutralizing material 26 is *not* a filter, but rather is provided and positioned to induce a neutralizing chemical treatment of the effluent exiting screens 24, to reduce the pH of the effluent. All effluent exiting the screens 24 *must* pass through neutralizing material 26 before passing to cooling means 29 and 30 for cooling and/or further filtering. Thus, neutralizing material 26 is not a filter but rather *separates* the two filter assemblies formed by screens 22, 24 and cooling means 29, 30.

As the two filter assemblies described in the reference are separated by pH neutralizing material 26, *neither* of the filter assemblies (comprising screens 22, 24 and cooling means 29, 30) include all of the above-mentioned features recited in claim 1. That is, neither filter abuts ***both*** a booster cup end surface *and* a perforated disc which abuts a nozzle "positioned at an end of said inflator... for supplying an inflation gas to an inflatable restraint system "as set forth in claim 1.

The present invention utilizes a single filter rather than multiple filter assemblies, making it simpler, less costly, more compact, and easier to manufacture than the devices disclosed in Kirchoff et al. '545. The added compactness of the present design makes it suitable for use in a wider variety of applications such as, for example, an airbelt.

C) Kirchoff et al. '545 discloses no operational mode in which a plurality of apertures is formed in an outer peripheral wall of a booster cup, *and* in which an initiator assembly is operable to activate a propellant charge contained within a booster tube.

The operational modes of the gas generator of Kirchoff et al. '545 are described in column 3, lines 34-63, continuing through column 4, lines 1-4:

"When the vehicle, in which the present invention is installed, collides with some other object, sensing devices, not a part of the present invention, deliver an electric signal. This signal or signals will then cause one or both electric squibs 19 and 20 to be fired. If the impact is severe, both squibs will be fired simultaneously for maximum effectiveness in delivering gases to the inflatable structure with maximum speed. However, if the impact is less severe, only the downstream squib 20 will be fired. In the latter case, *combustion will proceed upstream through the partition 15 to ignite the squib 19 and the gas generant 18 in the upstream chamber 16.* This provides a slower rate of inflation to provide a softer cushioning effect, but with the same quantity of gas.

It will be noted that the pyrotechnic material 21 that is contiguous with the upstream squib 19 extends well into the downstream gas generant chamber 17 via the tube 34 that holds both squibs 19 and 20 and the associated pyrotechnic materials 21. This tube 34 is made of very thin (about 5 mils) aluminum. Hence, in the event that a collision is of the low level type, wherein *only the downstream squib 20 is ignited by an electric signal, the heat from the burning gas generant 18 in the downstream chamber 17 will be rapidly transmitted through the wall of the tube 34 to ignite the pyrotechnic material 21 that is associated with the upstream squib 19. The squib 19 and its pyrotechnic material 21 will then rupture the wall of the tube 34 to ignite the gas generant material 18 in the upstream chamber 16.* This causes a somewhat slower delivery of gases to an inflatable structure than in the case of a high-level impact wherein both squibs are fired simultaneously." (emphasis added)

Thus, the reference discloses two operational modes for the device described therein. In a first mode, both squibs are activated simultaneously, producing rupture of tube 34. But, as stated previously, *after* the tube has been ruptured, neither of squibs 19 and 20 is operable to activate a propellant charge contained within the tube.

In a second mode (designed for low-level collision), squibs 19 and 20 are activated sequentially and essentially define *two separate initiation* systems, with each initiation system configured for igniting a respective *separate* collection of gas generant positioned in a corresponding one of chambers 16 and 17. As stated in column 2, lines 66-68, continuing through to column 3, line 1:

"*Each chamber* 16 and 17 is further equipped with an electric squib 19 and 20, respectively, surrounded by a pyrotechnic material 21." (emphasis added)

If the structure disclosed in Kirchoff et al. '545 did not form a separate initiation mechanism for each of chambers 16 and 17, then any activation of either of squibs 19 or 20 would result in near-simultaneous combustion of all the gas generant in *both* of chambers 16 and 17, making the phased gas deployment described in the reference impossible.

Even though the squibs are activated sequentially in the second mode, only downstream squib 20 is activated by an electrical signal. As explained in the above portions of Kirchoff et al. '545, when only the downstream squib 20 is ignited by an electric signal, the heat from the burning gas generant 18 in the downstream chamber 17 will be transmitted through the wall of the tube 34 to ignite the pyrotechnic material 21 that is associated with the upstream squib 19. The squib 19 and its pyrotechnic material 21 will then rupture the wall of the tube 34 to ignite the gas generant material 18 in the upstream chamber 16. The plain language of claim 1 of Kirchoff et al. '545 makes this clear:

> "1. In a gas generator for delivering gas to an inflatable structure in response to a sensor, said generator including a housing having an outlet orifice in communication with said inflatable structure, a gas generant material in said housing, and filtering and cooling means between said gas generant material and said orifice, the improvement comprising: a consumable partition dividing said gas generant material into first and second portions; a first electric-initiated igniter adjacent said first portion for igniting it in response to any signal from said sensor; a second electric-initiated igniter adjacent said second portion for igniting it in response to only a high-level signal from said sensor, said second igniter extending through said partition from said second portion into said first portion, *whereby said second igniter may be ignited either simultaneously with said first igniter in response to said high-level signal, or sequentially, with respect to said first igniter, by the heat of combustion from said first portion.*" (emphasis added)

Thus, in the sequential mode of operation, *upstream squib 19 is activated by combustion of the pyrotechnic material 21 associated with the squib*, rather than combustion of the pyrotechnic material 21 being initiated by squib 19. Therefore, in the mode of operation in which squibs 19 and 20 are activated sequentially, squib 19 is not operable to activate a propellant charge 21 positioned within tube 34 because *combustion of the propellant charge 21 is designed to produce activation of the squib*. Thus, as squib 19 is inoperable to activate a propellant charge within tube 34 even after activation of squib 20 and any resulting rupture of tube 34 in the vicinity of squib 20, the device disclosed in Kirchoff et al. '545 cannot simultaneously include **both** "...a plurality of apertures formed in said outer peripheral wall" and "...an initiator assembly operable to activate said first propellant charge" as set forth in claim 1 of the present application. In consequence, neither operational mode provides a device in which ***both*** a plurality of apertures is formed in an outer peripheral wall of a booster cup, *and* in which an initiator assembly is operable to activate a propellant charge contained within the booster tube.

D) Kirchoff et al. '545 also does not teach in inflator including all of the following elements recited in claim 1 of the present application:

> **"...a substantially cylindrical booster cup extending in said body, said booster cup having an outer peripheral wall and an end surface extending radially inwardly from said wall;**
> **a plurality of apertures formed in said outer peripheral wall;**
> **a first propellant charge positioned in said booster cup;**
> **a second propellant charge positioned in said inflator body;**
> **an initiator assembly operable to activate said first propellant charge, wherein a combustion thereof initiates a combustion of said second propellant charge and ejection of an inflation gas from said inflator body..."**

As noted previously, the only point in time at which Kirchoff et al. '545 even *implies* the existence of *multiple* ruptures in tube 34 is *after* the activation of both squib 19 and squib 20. Also as noted previously, after both of squibs 19 and 20 have been activated, neither squib is operable to activate a propellant charge contained in tube 34. However, during sequential operation of squibs 19 and 20, even if upstream squib 19 were considered to be operable to activate pyrotechnic material 21 surrounding the squib, combustion of the gas generant in chamber 16 associated with squib 19 would not "...initiate... ejection of an inflation gas from said

inflator body..." as recited in claim 1 of the present application. Where squibs 19 and 20 are operated sequentially, downstream squib 20 activates first, to initiate combustion of the gas generant contained in chamber 17. Therefore, it is squib 20 which *initiates* combustion of a second propellant charge in the gas generator, and which *initiates* ejection of inflation gas from the gas generator.

Stated another way, prior to activation of either of squibs 19 and 20 (when the squibs *are* operable to activate a pyrotechnic material within tube 34), there are no ruptures formed in tube 34, and all the terms of claim 1 are not met by the device disclosed in Kirchoff et al. '545. In addition, after the formation of even a single rupture in tube 34 resulting from the activation of downstream squib 20 (which initiates combustion of the gas generant in chamber 17 and the ejection of an inflation gas from the gas generator housing), all the terms of claim 1 are still not met by the device disclosed in Kirchoff et al. '545, because subsequent activation of squib 19 (even if it were considered operable to activate pyrotechnic material 21) cannot *initiate* "...ejection of an inflation gas from said inflator body" as recited in claim 1 of the present application; ejection of gases has *already been initiated* by the combustion of the gas generant in chamber 17.

As stated previously, a claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). Also, the identical invention must be shown in as complete detail as is contained in the claim. *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989). As no embodiment of the device disclosed in Kirchoff et al. '545 includes all of the elements recited in claim 1 of the present application, the rejection of claim 1 under 35 U.S.C. 102(b) in view of Kirchoff et al. '545 should be reversed and claim 1 allowed.

CLAIM 2

Claim 2 recites:

"2. The inflator of claim 1 wherein said inflator body comprises an inner peripheral wall separated from said outer peripheral wall by a substantially annular space; and
said second propellant charge is positioned in said space."

As claim 2 depends from independent claim 1, the remarks set forth with regard to the patentability of claim 1 in response to the rejection under 35 U.S.C. §102(b) over Kirchoff et al. '545 are equally applicable with regard to claim 2 and are incorporated herein by reference as if fully stated. Therefore, as the rejection of claim 1 under 35 U.S.C. §102(b) over Kirchoff et al. '545 is deemed overcome, the rejection of claim 2 under 35 U.S.C. §102(b) over Kirchoff et al. '545 should be reversed and claim 2 allowed.

CLAIM 3

Claim 3 recites:

"3. The inflator of claim 2 wherein said second propellant charge is positioned substantially adjacent said outer peripheral wall."

As claim 3 depends from independent claim 1, the remarks set forth with regard to the patentability of claim 1 in response to the rejection under 35 U.S.C. §102(b) over Kirchoff et al. '545 are equally applicable with regard to claim 3 and are incorporated herein by reference as if fully stated. Therefore, as the rejection of claim 1 under 35 U.S.C. §102(b) over Kirchoff et al. '545 is deemed overcome, the rejection of claim 3 under 35 U.S.C. §102(b) over Kirchoff et al. '545 should be reversed and claim 3 allowed.

CLAIM 4

Claim 4 recites:

"4. The inflator of claim 3 wherein said second propellant charge comprises a plurality of propellant tablets."

As claim 4 depends from independent claim 1, the remarks set forth with regard to the patentability of claim 1 in response to the rejection under 35 U.S.C. §102(b) over Kirchoff et al. '545 are equally applicable with regard to claim 4 and are incorporated herein by reference as if fully stated. Therefore, as the rejection of claim 1 under 35 U.S.C. §102(b) over Kirchoff et al. '545 is deemed overcome, the rejection of claim 4 under 35 U.S.C. §102(b) over Kirchoff et al. '545 should be reversed and claim 4 allowed.

CLAIM 5

Claim 5 recites:

"5. The inflator of claim 3 wherein said second propellant charge substantially fills the space between the outer peripheral wall and the inner peripheral wall of the inflator body."

As claim 5 depends from independent claim 1, the remarks set forth with regard to the patentability of claim 1 in response to the rejection under 35 U.S.C. §102(b) over Kirchoff et al. '545 are equally applicable with regard to claim 5 and are incorporated herein by reference as if fully stated. Therefore, as the rejection of claim 1 under 35 U.S.C. §102(b) over Kirchoff et al. '545 is deemed overcome, the rejection of claim 5 under 35 U.S.C. §102(b) over Kirchoff et al. '545 should be reversed and claim 5 allowed.

CLAIM 6

Claim 6 recites:

"6. The inflator of claim 5 wherein said filter constrains said second propellant charge in said space."

As claim 6 depends from independent claim 1, the remarks set forth with regard to the patentability of claim 1 in response to the rejection under 35 U.S.C. §102(b) over Kirchoff et al. '545 are equally applicable with regard to claim 6 and are incorporated herein by reference as if fully stated. Therefore, as the rejection of claim 1 under 35 U.S.C. §102(b) over Kirchoff et al. '545 is deemed overcome, the rejection of claim 6 under 35 U.S.C. §102(b) over Kirchoff et al. '545 should be reversed and claim 6 allowed.

CLAIM 7

Claim 7 recites:

"7. An inflator for an inflatable restraint system in a vehicle comprising:
an inflator body having first and second ends and an inner peripheral wall;
a booster cup extending in said body and having an outer peripheral wall and an end surface extending inwardly from said outer peripheral wall, said booster cup having a first propellant charge positioned therein;
said inner peripheral wall and said outer peripheral wall are separated by a substantially annular space having a second propellant charge positioned therein;
an initiator assembly disposed proximate said first end and operable to ignite said first propellant charge;
a filter abutting said booster cup end surface;
a perforated disc abutting said filter; and
a nozzle positioned at said second end of said body and abutting said perforated disc, said nozzle defining a nozzle outlet for supplying an inflation gas to the inflatable restraint system."

The remarks set forth with regard to the patentability of claim 1 in response to the rejection under 35 U.S.C. §102(b) over Kirchoff et al. '545 are equally applicable with regard to claim 7, especially those remarks relating to the filter assemblies disclosed in the reference, and are incorporated herein by reference as if fully stated. That is, Applicants believe that Kirchoff et al. '545 does not teach an inflator including a single filter which abuts ***both*** a booster cup end surface *and* a perforated disc which, in turn, abuts a nozzle "positioned at said second end of said body... for supplying an inflation gas to the inflatable restraint system "as set forth in claim 7 of the present application.

As stated previously with respect to claim 1, Applicants believe that the gas generator of Kirchoff et al. '545 incorporates *two separated* filter assemblies, rather than a *single* filter as disclosed in the present invention. In the reference, filtering screens 22 and coarse screen 24 combine to form a first filter assembly, and cooling means 29 and 30 combine to form a second filter assembly. As stated in column 3, lines 9-28 of the reference:

"A plurality of layers of filtering screens 22, comprising relatively fine wire screen (about 30 to 60 mesh) is adjacent the end of the container 14 and is retained in place by a first perforated plate 23 having the same diameter as the inside of the housing 6. A spacing means consisting of a plurality of layers of coarse screen 24 (about 8 to 16 mesh) separates the filtering screens 22 from the perforated

> plate 23 to provide a free-flow volume of space for gases that may emerge from the container 14 when the gas generant material 18 is fired. *A plastic-film bag 25, containing a pH neutralizing material 26 is retained in a position adjacent the first perforated plate 23 by a second perforated plate 27. A preferred pH neutralizing material 26 is powdered iron sulfate, Fe.sub.2 $(SO_4)_3$ or $FeSO_4$.* A cooling means 28 is made in two sections, the first section 29 comprises a plurality of layers of coarse wire screen similar to the spacing means 24, and the second section 30 comprising a plurality of layers of fine wire screen similar to the filtering screens 22." (emphasis added)

Thus, the two filter assemblies described above are separated by a plastic-film bag 25 containing a pH neutralizing material 26 and retained in a position adjacent a first perforated plate 23 by a second perforated plate 27. This neutralizing material 26 is *not* a filter, but rather is provided and positioned to induce a neutralizing chemical treatment of the effluent exiting screens 24, to reduce the pH of the effluent. All effluent exiting the screens 24 *must* pass through neutralizing material 26 before passing to cooling means 29 and 30 for cooling and/or further filtering. Thus, neutralizing material 26 is not a filter but rather *separates* the two filter assemblies formed by screens 22, 24 and cooling means 29, 30.

As the two filter assemblies described in the reference are separated by pH neutralizing material 26, *neither* of the filter assemblies (comprising screens 22, 24 and cooling means 29, 30) include all of the above-mentioned features recited in claim 1. That is, neither filter abuts ***both*** the booster cup end surface *and* a perforated disc which, in turn, abuts a nozzle "positioned at said second end of said body... for supplying an inflation gas to an inflatable restraint system "as set forth in claim 7.

As stated previously, a claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). Also, the identical invention must be shown in as complete detail as is contained in the claim. *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989). As no embodiment of the device disclosed in Kirchoff et al. '545 includes all of the elements recited in claim 7 of the present application, the rejection of claim 7 under 35 U.S.C. 102(b) in view of Kirchoff et al. '545 should be reversed and claim 7 allowed.

CLAIM 9

Claim 9 recites:

> "9. The inflator of claim 7 wherein said body has a total length and an area defined by a cross-section thereof, and said filter has a given length about one-fourth to one-half of the total length of the body, said filter occupying a volume determined by multiplying the cross-section of said body by the length of said filter."

On page 7 of the final Office Action (paper no. 20061004), the Examiner states:

> "7. Applicant's arguments filed 04 August 2006 have been fully considered but they are not persuasive. Regarding claim 9, MPEP § 2125 states in part:

> When the reference does not disclose that the drawings are to scale and is silent as to dimensions, arguments based on measurement of the drawing features are of little value. See Hockerson-Halberstadt, Inc. v. Avia Group Int 'I, 222 F.3d 951, 956, 55 USPQ2d 1487, 1491 (Fed. Cir. 2000) (The disclosure gave no indication that the drawings were drawn to scale. "[I]t is well established that patent drawings do not define the precise proportions of the elements and may not be relied on to show particular sizes if the specification is completely silent on the issue."). ***However, the description of the article pictured can be relied on, in combination with the drawings, for what they would reasonably teach one of ordinary skill in the art. In re Wright, 569 F.2d 1124, 193 USPQ 332 (CCPA 1977).***

Per the italicized portion above, while the drawings in the Kirchoff et al. reference are not necessarily drawn to scale, one of ordinary skill in the art could determine from the description and the drawings that the filter has a given length "about one-fourth to one-half of the total length" of the inflator body."

As claim 9 depends from independent claim 7, the remarks set forth with regard to the patentability of claim 7 in response to the rejection under 35 U.S.C. §102(b) over Kirchoff et al. '545 are equally applicable with regard to claim 9 and are incorporated herein by reference as if fully stated. Therefore, as the rejection of claim 7 under 35 U.S.C. §102(b) over Kirchoff et al. '545 is deemed overcome, the rejection of claim 9 under 35 U.S.C. §102(b) over Kirchoff et al. '545 should be reversed and claim 9 allowed.

In addition, Applicants believe that there is nothing in the description or drawings of Kirchoff et al. '545 that would reasonably teach to one of ordinary skill in the art a filter having "....a given length about one-fourth to one-half of the total length of the body..." as recited in claim 9 of the present application. The variations in filter length and the advantages of tailoring the length of the filter according to design requirements are described on page 4, lines 27-34, continuing through to page 5, line 1 of the present application:

> "A cylindrical filter 38, preferably a metallic mesh filter, is positioned in inflator body 12, and filters particulate materials generated by the combustion of propellant charges 18 and 28. Filter 38 fills a volume of the housing 12 defined by the cross-section of filter 38 (shown in Figure 6) spanning from a point l_1 to a second point l_2. The longitudinal distance defined by the distance between l_1 and l_2 ranges from about one-fourth to one half of the total length of housing 12, or l_T. Adjustment of the length of the filter 38 therefore increases or reduces the pressure of the gas at the second end 13 and as such, may function as a filter, a gas pressure throttle, and/or a heat sink depending on design criteria."

The disclosure of Kirchoff et al. '545 is silent as to the dimensions of the filter assemblies disclosed therein, and is also silent as to whether the drawings shown therein are to scale. In addition, the reference makes *no mention* of any allowance for dimensional variations in the filter assemblies such as those described in the present application, and does not even *suggest* any range of longitudinal filter dimensions such as that set forth in the present application. The reference also *mentions no advantages* of being able to tailor the length of the filter according to design requirements.

As Kirchoff et al. '545 contains no teaching or suggestion of adjusting the length of the filters according to design requirements, and also does not mention any advantages conferred by enabling adjustment of the longitudinal filter dimension according to design requirements, it is difficult to see how the reference could

reasonably teach one of ordinary skill in the art the matter recited in claim 9 of the present application. For this reason, the rejection of claim 9 under 35 U.S.C. §102(b) over Kirchoff et al. '545 should be reversed and claim 9 allowed.

CLAIM 10

Claim 10 recites:

"10. The inflator of claim 7 wherein said booster cup is a substantially cylindrical elongate member substantially coaxial with said inflator body."

As claim 10 depends from independent claim 7, the remarks set forth with regard to the patentability of claim 7 in response to the rejection under 35 U.S.C. §102(b) over Kirchoff et al. '545 are equally applicable with regard to claim 10 and are incorporated herein by reference as if fully stated. Therefore, as the rejection of claim 7 under 35 U.S.C. §102(b) over Kirchoff et al. '545 is deemed overcome, the rejection of claim 10 under 35 U.S.C. §102(b) over Kirchoff et al. '545 should be reversed and claim 10 allowed.

CLAIM 11

Claim 11 recites:

"11. The inflator of claim 10 wherein said booster cup includes a plurality of apertures formed in said outer peripheral wall."

As claim 11 depends from independent claim 7, the remarks set forth with regard to the patentability of claim 7 in response to the rejection under 35 U.S.C. §102(b) over Kirchoff et al. '545 are equally applicable with regard to claim 11 and are incorporated herein by reference as if fully stated. Therefore, as the rejection of claim 7 under 35 U.S.C. §102(b) over Kirchoff et al. '545 is deemed overcome, the rejection of claim 11 under 35 U.S.C. §102(b) over Kirchoff et al. '545 should be reversed and claim 11 allowed.

CLAIM 12

Claim 12 recites:

"12. The inflator of claim 11 wherein said substantially annular space extends longitudinally in said inflator body from a point proximate said first end up to a point substantially coplanar with said end surface."

As claim 12 depends from independent claim 7, the remarks set forth with regard to the patentability of claim 7 in response to the rejection under 35 U.S.C. §102(b) over Kirchoff et al. '545 are equally applicable with regard to claim 12 and are incorporated herein by reference as if fully stated. Therefore, as the rejection of claim 7 under 35 U.S.C. §102(b) over Kirchoff et al. '545 is deemed overcome, the rejection of claim 12 under 35 U.S.C. §102(b) over Kirchoff et al. '545 should be reversed and claim 12 allowed.

CLAIM 13

Claim 13 recites:

"13. The inflator of claim 7 wherein said filter is substantially cylindrical and includes a substantially cylindrical periphery positioned adjacent said inner peripheral wall, and a substantially planar end positioned flush with said end surface."

As claim 13 depends from independent claim 7, the remarks set forth with regard to the patentability of claim 7 in response to the rejection under 35 U.S.C. §102(b) over Kirchoff et al. '545 are equally applicable with regard to claim 13 and are incorporated herein by reference as if fully stated. Therefore, as the rejection of claim 7 under 35 U.S.C. §102(b) over Kirchoff et al. '545 is deemed overcome, the rejection of claim 13 under 35 U.S.C. §102(b) over Kirchoff et al. '545 should be reversed and claim 13 allowed.

CLAIM 14

Claim 14 recites:

"14. An inflatable restraint system for a motor vehicle comprising:
an inflatable restraint device;
an inflator operable to provide an inflation gas to said inflatable restraint device, said inflator comprising an elongate substantially cylindrical inflator body having first and second ends and an inner peripheral wall;
an elongate booster cup mounted to said inflator body proximate said first end and extending substantially coaxially therewith, said booster cup having an outer peripheral wall separated from said inner peripheral wall by an annular space, and a plurality of apertures formed in said outer peripheral wall;
a propellant charge positioned in said space;
a filter positioned in said inflator body abutting an end portion of the booster cup , said filter securing said propellant charge in said space;
a perforated disc abutting said filter; and
a nozzle member proximate said second end of said inflator body and abutting said perforated disc, said nozzle member constraining said filter against axial displacement."

The remarks set forth with regard to the patentability of claim 1 in response to the rejection under 35 U.S.C. §102(b) over Kirchoff et al. '545 are equally applicable with regard to claim 14, especially those remarks

relating to the filter assemblies disclosed in the reference, and are incorporated herein by reference as if fully stated. That is, Applicants believe that Kirchoff et al. '545 does not teach an inflator including a single filter which abuts ***both*** a booster cup end portion *and* a perforated disc which, in turn, abuts a nozzle member positioned "proximate said second end of said inflator body... "as set forth in claim 14.

As stated previously, Applicants believe that the gas generator of Kirchoff et al. '545 incorporates *two* filter assemblies separated by a pH neutralizing material, rather than a *single* filter as disclosed in the present invention. In the reference, filtering screens 22 and coarse screen 24 combine to form a first filter assembly, and cooling means 29 and 30 combine to form a second filter assembly. As stated in column 3, lines 9-28 of the reference:

> "A plurality of layers of filtering screens 22, comprising relatively fine wire screen (about 30 to 60 mesh) is adjacent the end of the container 14 and is retained in place by a first perforated plate 23 having the same diameter as the inside of the housing 6. A spacing means consisting of a plurality of layers of coarse screen 24 (about 8 to 16 mesh) separates the filtering screens 22 from the perforated plate 23 to provide a free-flow volume of space for gases that may emerge from the container 14 when the gas generant material 18 is fired. *A plastic-film bag 25, containing a pH neutralizing material 26 is retained in a position adjacent the first perforated plate 23 by a second perforated plate 27. A preferred pH neutralizing material 26 is powdered iron sulfate, Fe.sub.2 $(SO_4)_3$ or $FeSO_4$.* A cooling means 28 is made in two sections, the first section 29 comprises a plurality of layers of coarse wire screen similar to the spacing means 24, and the second section 30 comprising a plurality of layers of fine wire screen similar to the filtering screens 22." (emphasis added)

Thus, the two filter assemblies described above are separated by a plastic-film bag 25 containing a pH neutralizing material 26 and retained in a position adjacent a first perforated plate 23 by a second perforated plate 27. This neutralizing material 26 is *not* a filter, but rather is provided and positioned to induce a neutralizing chemical treatment of the effluent exiting screens 24, to reduce the pH of the effluent. All effluent exiting the screens 24 *must* pass through neutralizing material 26 before passing to cooling means 29 and 30 for cooling and/or further filtering. Thus, neutralizing material 26 is not a filter but rather *separates* the two filter assemblies formed by screens 22, 24 and cooling means 29, 30.

As the two filter assemblies described in the reference are separated by pH neutralizing material 26, *neither* of the filter assemblies (comprising screens 22, 24 and cooling means 29, 30) include all of the above-mentioned features recited in claim 1. That is, neither filter abuts ***both*** a booster cup end portion *and* a perforated disc which, in turn, abuts a nozzle member "positioned at said second end of said inflator body... "as set forth in claim 14.

As stated previously, a claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). Also, the identical invention must be shown in as complete detail as is contained in the claim. *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989). As no embodiment of the device disclosed in Kirchoff et al. '545

includes all of the elements recited in claim 14 of the present application, the rejection of claim 14 under 35 U.S.C. 102(b) in view of Kirchoff et al. '545 should be reversed and claim 14 allowed.

CLAIM 15

Claim 15 recites:

"15. The inflatable restraint system of claim 14 wherein said propellant charge comprises a plurality of gas generant tablets positioned in a geometrically ordered fashion in said annular space."

As claim 15 depends from independent claim 14, the remarks set forth with regard to the patentability of claim 14 in response to the rejection under 35 U.S.C. §102(b) over Kirchoff et al. '545 are equally applicable with regard to claim 15 and are incorporated herein by reference as if fully stated. Therefore, as the rejection of claim 14 under 35 U.S.C. §102(b) over Kirchoff et al. '545 is deemed overcome, the rejection of claim 15 under 35 U.S.C. §102(b) over Kirchoff et al. '545 should be reversed and claim 15 allowed.

CLAIM 16

Claim 16 recites:

"16. The inflatable restraint system of claim 15 wherein said propellant charge comprises a plurality of gas generant tablets stacked adjacently in said annular space and having cylindrical axes oriented substantially perpendicular said inner peripheral wall."

As claim 16 depends from independent claim 14, the remarks set forth with regard to the patentability of claim 14 in response to the rejection under 35 U.S.C. §102(b) over Kirchoff et al. '545 are equally applicable with regard to claim 16 and are incorporated herein by reference as if fully stated. Therefore, as the rejection of claim 14 under 35 U.S.C. §102(b) over Kirchoff et al. '545 is deemed overcome, the rejection of claim 16 under 35 U.S.C. §102(b) over Kirchoff et al. '545 should be reversed and claim 16 allowed.

CLAIM 17

Claim 17 recites:

"17. The inflatable restraint system of claim 14 wherein said nozzle is threadedly engaged with said inflator body."

As claim 17 depends from independent claim 14, the remarks set forth with regard to the patentability of claim 14 in response to the rejection under 35 U.S.C. §102(b) over Kirchoff et al. '545 are equally applicable

with regard to claim 17 and are incorporated herein by reference as if fully stated. Therefore, as the rejection of claim 14 under 35 U.S.C. §102(b) over Kirchoff et al. '545 is deemed overcome, the rejection of claim 17 under 35 U.S.C. §102(b) over Kirchoff et al. '545 should be reversed and claim 17 allowed.

CLAIM 18

Claim 18 recites:

"18. The inflatable restraint system of claim 14 wherein said filter is secured against said booster cup, thereby constraining said tablets from movement in said annular space."

As claim 18 depends from independent claim 14, the remarks set forth with regard to the patentability of claim 14 in response to the rejection under 35 U.S.C. §102(b) over Kirchoff et al. '545 are equally applicable with regard to claim 18 and are incorporated herein by reference as if fully stated. Therefore, as the rejection of claim 14 under 35 U.S.C. §102(b) over Kirchoff et al. '545 is deemed overcome, the rejection of claim 18 under 35 U.S.C. §102(b) over Kirchoff et al. '545 should be reversed and claim 18 allowed.

CLAIM 19

Claim 19 recites:

"19. The inflatable restraint system of claim 14 further comprising a propellant charge positioned in said booster cup."

As claim 19 depends from independent claim 14, the remarks set forth with regard to the patentability of claim 14 in response to the rejection under 35 U.S.C. §102(b) over Kirchoff et al. '545 are equally applicable with regard to claim 19 and are incorporated herein by reference as if fully stated. Therefore, as the rejection of claim 14 under 35 U.S.C. §102(b) over Kirchoff et al. '545 is deemed overcome, the rejection of claim 19 under 35 U.S.C. §102(b) over Kirchoff et al. '545 should be reversed and claim 19 allowed.

CLAIM 20

Claim 20 recites:

"20. The inflatable restraint system of claim 14 further comprising an initiator body within said inflator body proximate said first end;
wherein said booster cup is attached to said initiator body and suspended therefrom, said booster cup supported in said inflator body solely by said attachment with said initiator body."

As claim 20 depends from independent claim 14, the remarks set forth with regard to the patentability of claim 14 in response to the rejection under 35 U.S.C. §102(b) over Kirchoff et al. '545 are equally applicable with regard to claim 20 and are incorporated herein by reference as if fully stated. Therefore, as the rejection of claim 7 under 35 U.S.C. §102(b) over Kirchoff et al. '545 is deemed overcome, the rejection of claim 20 under 35 U.S.C. §102(b) over Kirchoff et al. '545 should be reversed and claim 20 allowed.

CLAIM 21

Claim 21 recites:

"21. The inflatable restraint system of claim 14 wherein the inflatable restraint device is an airbag."

As claim 21 depends from independent claim 14, the remarks set forth with regard to the patentability of claim 14 in response to the rejection under 35 U.S.C. §102(b) over Kirchoff et al. '545 are equally applicable with regard to claim 21 and are incorporated herein by reference as if fully stated. Therefore, as the rejection of claim 14 under 35 U.S.C. §102(b) over Kirchoff et al. '545 is deemed overcome, the rejection of claim 21 under 35 U.S.C. §102(b) over Kirchoff et al. '545 should be reversed and claim 21 allowed.

CLAIM 27

Claim 27 recites:

"27. An inflator module for a vehicle occupant protection system comprising:
a module housing;
an inflator positioned in said housing, said inflator comprising a booster cup mounted to an inflator body and extending substantially coaxially therewith, said booster cup having an outer peripheral wall partially defining an annular space and a plurality of apertures formed in said outer peripheral wall;
a propellant charge positioned in said space;
a filter positioned in said inflator abutting an end portion of said booster cup for securing said propellant charge in said space;
a perforated disc abutting said filter; and
a nozzle positioned at an end of said inflator and abutting said perforated disc for supplying an inflation gas to the inflatable vehicle occupant protection system. "

The remarks set forth with regard to the patentability of claim 1 in response to the rejection under 35 U.S.C. §102(b) over Kirchoff et al. '545 are equally applicable with regard to claim 27, especially those remarks relating to the filter assemblies disclosed in the reference, and are incorporated herein by reference as if fully stated. That is, Applicants believe that Kirchoff et al. '545 does not teach an inflator including a single filter which abuts ***both*** a booster cup end surface *and* a perforated disc which, in turn, abuts a nozzle "positioned at an end of said inflator...for supplying an inflation gas to the inflatable vehicle occupant protection system "as set forth in claim 27 of the present application.

As stated previously with respect to claim 1, Applicants believe that the gas generator of Kirchoff et al. '545 incorporates *two separated* filter assemblies, rather than a *single* filter as disclosed in the present invention. In the reference, filtering screens 22 and coarse screen 24 combine to form a first filter assembly, and cooling means 29 and 30 combine to form a second filter assembly. As stated in column 3, lines 9-28 of the reference:

> "A plurality of layers of filtering screens 22, comprising relatively fine wire screen (about 30 to 60 mesh) is adjacent the end of the container 14 and is retained in place by a first perforated plate 23 having the same diameter as the inside of the housing 6. A spacing means consisting of a plurality of layers of coarse screen 24 (about 8 to 16 mesh) separates the filtering screens 22 from the perforated plate 23 to provide a free-flow volume of space for gases that may emerge from the container 14 when the gas generant material 18 is fired. *A plastic-film bag 25, containing a pH neutralizing material 26 is retained in a position adjacent the first perforated plate 23 by a second perforated plate 27. A preferred pH neutralizing material 26 is powdered iron sulfate, Fe.sub.2 $(SO_4)_3$ or $FeSO_4$.* A cooling means 28 is made in two sections, the first section 29 comprises a plurality of layers of coarse wire screen similar to the spacing means 24, and the second section 30 comprising a plurality of layers of fine wire screen similar to the filtering screens 22." (emphasis added)

Thus, the two filter assemblies described above are separated by a plastic-film bag 25 containing a pH neutralizing material 26 and retained in a position adjacent a first perforated plate 23 by a second perforated plate 27. This neutralizing material 26 is *not* a filter, but rather is provided and positioned to induce a neutralizing chemical treatment of the effluent exiting screens 24, to reduce the pH of the effluent. All effluent exiting the screens 24 *must* pass through neutralizing material 26 before passing to cooling means 29 and 30 for cooling and/or further filtering. Thus, neutralizing material 26 is not a filter but rather *separates* the two filter assemblies formed by screens 22, 24 and cooling means 29, 30.

As the two filter assemblies described in the reference are separated by pH neutralizing material 26, *neither* of the filter assemblies (comprising screens 22, 24 and cooling means 29, 30) include all of the above-mentioned features recited in claim 1. That is, neither filter abuts ***both*** the booster cup end surface *and* a perforated disc which abuts a nozzle "positioned at an end of said inflator ... for supplying an inflation gas to the inflatable vehicle occupant protection system"as set forth in claim 27.

As stated previously, a claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). Also, the identical invention must be shown in as complete detail as is contained in the claim. *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989). As no embodiment of the device disclosed in Kirchoff et al. '545 includes all of the elements recited in claim 27 of the present application, the rejection of claim 27 under 35 U.S.C. 102(b) in view of Kirchoff et al. '545 should be reversed and claim 27 allowed.

CLAIM 28

Claim 28 recites:

"28. The inflator module of claim 27 wherein said inflator comprises an inflator body having an inner peripheral wall opposing said outer peripheral wall, said inner and outer peripheral walls defining said space."

As claim 28 depends from independent claim 27, the remarks set forth with regard to the patentability of claim 27 in response to the rejection under 35 U.S.C. §102(b) over Kirchoff et al. '545 are equally applicable with regard to claim 28 and are incorporated herein by reference as if fully stated. Therefore, as the rejection of claim 27 under 35 U.S.C. §102(b) over Kirchoff et al. '545 is deemed overcome, the rejection of claim 28 under 35 U.S.C. §102(b) over Kirchoff et al. '545 should be reversed and claim 28 allowed.

CLAIM 29

Claim 29 recites:

"29. The inflator module of claim 28 wherein said filter member constrains said propellant charge in said space."

As claim 29 depends from independent claim 27, the remarks set forth with regard to the patentability of claim 27 in response to the rejection under 35 U.S.C. §102(b) over Kirchoff et al. '545 are equally applicable with regard to claim 13 and are incorporated herein by reference as if fully stated. Therefore, as the rejection of claim 27 under 35 U.S.C. §102(b) over Kirchoff et al. '545 is deemed overcome, the rejection of claim 29 under 35 U.S.C. §102(b) over Kirchoff et al. '545 should be reversed and claim 29 allowed.

CLAIM 30

Claim 30 recites:

"30. A method of manufacturing a gas generator comprising the steps of:
positioning a booster cup within an elongate substantially cylindrical inflator body;
placing a propellant charge in a space extending between an outer peripheral wall of the booster cup and an inner peripheral wall of the inflator body;
inserting a filter member into the inflator body up to a point at which the filter bears against an end surface of the booster cup;
positioning a perforated disc abutting said filter; and
positioning a nozzle member in the inflator body at a selected axial position and abutting said perforated disc such that the filter is constrained from axial movement between the nozzle member and the booster cup, whereby the filter secures the propellant charge in the space. "

The remarks set forth with regard to the patentability of claim 1 in response to the rejection under 35 U.S.C. §102(b) over Kirchoff et al. '545 are equally applicable with regard to claim 30, especially those remarks

relating to the filter assemblies disclosed in the reference, and are incorporated herein by reference as if fully stated. Applicants believe that Kirchoff et al. '545 does not teach a method of manufacturing a gas generator including the steps of "...inserting a filter member into the inflator body up to a point at which the filter bears against an end surface of the booster cup; positioning a perforated disc abutting said filter; and positioning a nozzle member in the inflator body at a selected axial position and abutting said perforated disc such that the filter is constrained from axial movement between the nozzle member and the booster cup, whereby the filter secures the propellant charge in the space. " as recited in claim 30 of the present application.

As stated previously with respect to claim 1, Applicants believe that the gas generator of Kirchoff et al. '545 incorporates *two separated* filter assemblies, rather than a *single* filter as disclosed in the present invention. In the reference, filtering screens 22 and coarse screen 24 combine to form a first filter assembly, and cooling means 29 and 30 combine to form a second filter assembly. As stated in column 3, lines 9-28 of the reference:

> "A plurality of layers of filtering screens 22, comprising relatively fine wire screen (about 30 to 60 mesh) is adjacent the end of the container 14 and is retained in place by a first perforated plate 23 having the same diameter as the inside of the housing 6. A spacing means consisting of a plurality of layers of coarse screen 24 (about 8 to 16 mesh) separates the filtering screens 22 from the perforated plate 23 to provide a free-flow volume of space for gases that may emerge from the container 14 when the gas generant material 18 is fired. *A plastic-film bag 25, containing a pH neutralizing material 26 is retained in a position adjacent the first perforated plate 23 by a second perforated plate 27. A preferred pH neutralizing material 26 is powdered iron sulfate, Fe.sub.2 $(SO_4)_3$ or $FeSO_4$.* A cooling means 28 is made in two sections, the first section 29 comprises a plurality of layers of coarse wire screen similar to the spacing means 24, and the second section 30 comprising a plurality of layers of fine wire screen similar to the filtering screens 22." (emphasis added)

Thus, the two filter assemblies described above are separated by a plastic-film bag 25 containing a pH neutralizing material 26 and retained in a position adjacent a first perforated plate 23 by a second perforated plate 27. This neutralizing material 26 is *not* a filter, but rather is provided and positioned to induce a neutralizing chemical treatment of the effluent exiting screens 24, to reduce the pH of the effluent. All effluent exiting the screens 24 *must* pass through neutralizing material 26 before passing to cooling means 29 and 30 for cooling and/or further filtering. Thus, neutralizing material 26 is not a filter but rather *separates* the two filter assemblies formed by screens 22, 24 and cooling means 29, 30.

As the two filter assemblies described in the reference are separated by pH neutralizing material 26, *neither* of the filter assemblies (comprising screens 22, 24 and cooling means 29, 30) include all of the above-mentioned features recited in claim 1. That is, neither filter ***both*** bears against a booster cup end surface *and* abuts a perforated disc which, in turn, abuts a nozzle member "...such that the filter is constrained from axial movement between the nozzle member and the booster cup, whereby the filter secures the propellant charge in the space." as recited in claim 30.

As stated previously, a claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). Also, the identical invention must be

shown in as complete detail as is contained in the claim. *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989). As no embodiment of the device disclosed in Kirchoff et al. '545 includes all of the elements recited in claim 30 of the present application, the rejection of claim 30 under 35 U.S.C. 102(b) in view of Kirchoff et al. '545 should be reversed and claim 30 allowed.

CLAIM 31

Claim 31 recites:

"31. The method of claim 30 wherein the step of placing a propellant charge in the space comprises placing propellant tablets therein."

As claim 31 depends from independent claim 30, the remarks set forth with regard to the patentability of claim 30 in response to the rejection under 35 U.S.C. §102(b) over Kirchoff et al. '545 are equally applicable with regard to claim 31 and are incorporated herein by reference as if fully stated. Therefore, as the rejection of claim 30 under 35 U.S.C. §102(b) over Kirchoff et al. '545 is deemed overcome, the rejection of claim 31 under 35 U.S.C. §102(b) over Kirchoff et al. '545 should be reversed and claim 31 allowed.

CLAIM 32

Claim 32 recites:

"32. The method of claim 31 wherein the step of placing the propellant charge in the space comprises placing the propellant tablets therein in a geometrically ordered fashion up to a point substantially coplanar with an end surface of the booster cup."

As claim 32 depends from independent claim 30, the remarks set forth with regard to the patentability of claim 30 in response to the rejection under 35 U.S.C. §102(b) over Kirchoff et al. '545 are equally applicable with regard to claim 32 and are incorporated herein by reference as if fully stated. Therefore, as the rejection of claim 30 under 35 U.S.C. §102(b) over Kirchoff et al. '545 is deemed overcome, the rejection of claim 32 under 35 U.S.C. §102(b) over Kirchoff et al. '545 should be reversed and claim 32 allowed.

In addition, the reference does not teach or even suggest the step of "placing the propellant tablets therein in a geometrically ordered fashion up to a point substantially coplanar with an end surface of the booster cup" as recited in claim 32. To the contrary, the drawing figure of the reference shows gas generant tablets 18 jumbled into chambers 16 and 17 and having no apparent preferred orientation of geometric order. Thus is in stark contrast to the ordered arrangement of gas generant 28 shown in FIG. 2 of the present application. For this reason, Kirchoff et al. '545 does not teach all of the elements recited in claim 32, and the rejection of claim 32 under 35 U.S.C. §102(b) over Kirchoff et al. '545 should be reversed and claim 32 allowed.

CLAIM 33

Claim 33 recites:

"33. The method of claim 30 wherein the filter length is sized to reduce or increase a gas pressure resulting from activation of the gas generator."

As claim 33 depends from independent claim 30, the remarks set forth with regard to the patentability of claim 30 in response to the rejection under 35 U.S.C. §102(b) over Kirchoff et al. '545 are equally applicable with regard to claim 33 and are incorporated herein by reference as if fully stated. Therefore, as the rejection of claim 30 under 35 U.S.C. §102(b) over Kirchoff et al. '545 is deemed overcome, the rejection of claim 33 under 35 U.S.C. §102(b) over Kirchoff et al. '545 should be reversed and claim 33 allowed.

In addition, the remarks set forth with regard to the patentability of claim 9 in response to the rejection under 35 U.S.C. §102(b) over Kirchoff et al. '545 are equally applicable with regard to claim 33, especially those remarks relating to the filter assemblies disclosed in the reference, and are incorporated herein by reference as if fully stated. That is, Applicants believe that there is nothing in the description or drawings of Kirchoff et al. '545 that would reasonably teach to one of ordinary skill in the art a filter having "....a given length about one-fourth to one-half of the total length of the body..." as recited in claim 9 of the present application. The variations in filter length and the advantages of tailoring the length of the filter according to design requirements are described on page 4, lines 27-34, continuing through to page 5, line 1 of the present application:

> "A cylindrical filter 38, preferably a metallic mesh filter, is positioned in inflator body 12, and filters particulate materials generated by the combustion of propellant charges 18 and 28. Filter 38 fills a volume of the housing 12 defined by the cross-section of filter 38 (shown in Figure 6) spanning from a point l_1 to a second point l_2. The longitudinal distance defined by the distance between l_1 and l_2 ranges from about one-fourth to one half of the total length of housing 12, or l_T. Adjustment of the length of the filter 38 therefore increases or reduces the pressure of the gas at the second end 13 and as such, may function as a filter, a gas pressure throttle, and/or a heat sink depending on design criteria."

The disclosure of Kirchoff et al. '545 is silent as to the dimensions of the filter assemblies disclosed therein, and is also silent as to whether the drawings shown therein are to scale. In addition, the reference makes *no mention* of any allowance for dimensional variations in the filter assemblies such as those described in the present application, and does not even *suggest* any range of longitudinal filter dimensions such as that set forth in the present application. The reference also *mentions no advantages* of being able to tailor the length of the filter according to design requirements. Thus, Kirchoff et al. '545 cannot teach the matter recited in claim 33 of the present application, and the rejection of claim 33 under 35 U.S.C. §102(b) over Kirchoff et al. '545 should be reversed and claim 33 allowed.

CLAIM 34

Claim 34 recites:

"34. A gas generator manufactured according to the method of claim 30."

As claim 34 depends from independent claim 30, the remarks set forth with regard to the patentability of claim 30 in response to the rejection under 35 U.S.C. §102(b) over Kirchoff et al. '545 are equally applicable with regard to claim 34 and are incorporated herein by reference as if fully stated. Therefore, as the rejection of claim 30 under 35 U.S.C. §102(b) over Kirchoff et al. '545 is deemed overcome, the rejection of claim 34 under 35 U.S.C. §102(b) over Kirchoff et al. '545 should be reversed and 34 allowed.

B. Rejection Under 35 U.S.C. §103(a) Over Schneider et al., U.S. Patent No. 6,279,945, in view of Kirchoff et al., U.S. Patent No. 3,972,545

On pages 6 and 7 of the final Office Action (paper no. 20061004), the Examiner states:

"6. Claims 14 and 22-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schneider et al. (6,279,945) in view of Kirchoff et al. (3,972,545). Schneider et al. disclose an inflatable restraint system (for example, an inflatable safety belt system) able to be used with a motor vehicle (including #10), comprising:

- Inflatable restraint device (including inflatable safety belt #24)
- Inflator (including #42) able to provide an inflation gas to the inflatable restraint device and comprising an elongate substantially cylindrical inflator body (can be seen in figure 1) having a first end (for example, bottom end as seen in figure 1) and a second end (for example, top end as seen in figure 1) and an inner peripheral wall (not shown, but would be interior wall of inflator body)
- Inflatable restraint is an airbelt (including #24)

Schneider et al. do not specifically disclose all of the interior features of the inflator, such as a booster cup, apertures, propellant charge, filter, or nozzle member.

Kirchoff et al. teach an inflatable restraint system, as set forth above, including an elongate booster cup, plurality of apertures, propellant charge, filter, and nozzle member. It would have been obvious to one skilled in the art at the time that the invention was made to modify the inflator of Schneider et al. such that it comprised booster cup, apertures, propellant charge, filter, and nozzle as claimed in view of the teachings of Kirchoff et al. so as to provide a practical, reliable, gas-generating system that will automatically respond to a signal and adjust the rate of inflation to be proportionate to the severity of impact, as well as other benefits (Kirchoff et al.: "Summary of the Invention")."

35 U.S.C. 103(a) states:

"(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made."

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

CLAIM 14

Claim 14 recites:

"14. An inflatable restraint system for a motor vehicle comprising:
an inflatable restraint device;
an inflator operable to provide an inflation gas to said inflatable restraint device, said inflator comprising an elongate substantially cylindrical inflator body having first and second ends and an inner peripheral wall;
an elongate booster cup mounted to said inflator body proximate said first end and extending substantially coaxially therewith, said booster cup having an outer peripheral wall separated from said inner peripheral wall by an annular space, and a plurality of apertures formed in said outer peripheral wall;
a propellant charge positioned in said space;
a filter positioned in said inflator body abutting an end portion of the booster cup , said filter securing said propellant charge in said space;
a perforated disc abutting said filter; and
a nozzle member proximate said second end of said inflator body and abutting said perforated disc, said nozzle member constraining said filter against axial displacement."

A prima facie case of obviousness of claim 1 in view of Schneider et al. '945 and Kirchoff et al. '545 has not been established because the references, when combined, do not teach or suggest all the limitations of claim 1.

The remarks set forth with regard to the patentability of claim 1 in response to the rejection under 35 U.S.C. §102(b) over Kirchoff et al. '545 are equally applicable with regard to the rejection of claim 14 under 35 U.S.C. §103(a) in view of Schneider et al. '945 and Kirchoff et al. '545, especially those remarks relating to the filter structure disclosed in Kirchoff et al. '545, and are incorporated herein by reference as if fully stated. That is, Applicants believe that the gas generator of Kirchoff et al. '545 incorporates *two separated* filter assemblies, rather than a *single* filter as disclosed in the present invention. In the reference, filtering screens 22 and coarse screen 24 combine to form a first filter assembly, and cooling means 29 and 30 combine to form a second filter assembly. As stated in column 3, lines 9-28 of the reference:

> "A plurality of layers of filtering screens 22, comprising relatively fine wire screen (about 30 to 60 mesh) is adjacent the end of the container 14 and is retained in place by a first perforated plate 23 having the same diameter as the inside of the housing 6. A spacing means consisting of a plurality of layers of coarse screen 24 (about 8 to 16 mesh) separates the filtering screens 22 from the perforated plate 23 to provide a free-flow volume of space for gases that may emerge from the container 14 when the gas generant material 18 is fired. *A plastic-film bag 25, containing a pH neutralizing material 26 is retained in a position adjacent the first perforated plate 23 by a second perforated plate 27. A preferred pH neutralizing material 26 is powdered iron sulfate, Fe.sub.2 $(SO_4)_3$ or $FeSO_4$.* A cooling means 28 is made in two sections, the first section 29 comprises a plurality of layers of coarse wire screen similar to the spacing means 24, and the second section 30 comprising a plurality of layers of fine wire screen similar to the filtering screens 22." (emphasis added)

Thus, the two filter assemblies described above are separated by a plastic-film bag 25 containing a pH neutralizing material 26 and retained in a position adjacent a first perforated plate 23 by a second perforated plate 27. This neutralizing material 26 is *not* a filter, but rather is provided and positioned to induce a neutralizing chemical treatment of the effluent exiting screens 24, to reduce the pH of the effluent. All effluent exiting the screens 24 *must* pass through neutralizing material 26 before passing to cooling means 29 and 30 for cooling and/or further filtering. Thus, neutralizing material 26 is not a filter but rather *separates* the two filter assemblies formed by screens 22, 24 and cooling means 29, 30.

As the two filter assemblies described in the reference are separated by pH neutralizing material 26, *neither* of the filter assemblies (comprising screens 22, 24 and cooling means 29, 30) include all of the above-mentioned features recited in claim 1. That is, neither filter abuts ***both*** a booster cup end portion *and* a perforated disc which, in turn, abuts a nozzle member "proximate said second end of said inflator body ..."as set forth in claim 14.

For the reasons set forth above, Kirchoff et al. '545 does not show or suggest all of the elements recited in claim 14 of the present application. In addition, the Examiner concedes that "Schneider et al. do not specifically disclose all of the interior features of the inflator, such as a booster cup, apertures, propellant charge, filter, or nozzle member." (Paper no. 20061004, page 6). Thus, even if the cited references were combined, no combination of the references would provide all of the features recited in claim 14. Therefore, a prima facie case of obviousness of claim 14 in view of in view of Schneider et al. '945 and Kirchoff et al. '545 has not been established, and the rejection of claim 14 under 35 U.S.C. 103(a) in view of the cited references should be reversed and claim 14 allowed.

CLAIM 22

Claim 22 recites:

"22. The inflatable restraint system of claim 14 wherein the inflatable restraint device is an airbelt."

The remarks set forth with regard to the patentability of claim 14 in response to the rejection under 35 U.S.C. §103(a) in view of Schneider et al. '945 and Kirchoff et al. '545 are equally applicable with regard to the rejection of claim 22, and are incorporated herein by reference as if fully stated. Also, as stated previously, a prima facie case of obviousness of claim 22 in view of the cited references has not been established. In addition, if an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. In re Fine, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). Thus, as claim 14 is deemed nonobvious, and as claim 22 depends from claim 14, claim 22 should also be deemed nonobvious. For these reasons, the rejection of claim 22 under 35 U.S.C. 103(a) in view of the cited references should be reversed and claim 22 allowed.

CLAIM 23

Claim 23 recites:

"23. An inflatable airbelt system for a motor vehicle comprising:
an inflatable airbelt;
an inflator operable to provide an inflation gas to said airbelt, said inflator comprising an inflator body and a booster cup extending in said body, said booster cup having an outer peripheral wall and an end surface extending radially inwardly from said wall;
said booster cup includes a plurality of apertures formed in said outer peripheral wall;
a first propellant charge positioned in said booster cup;
a second propellant charge positioned in said inflator body;
an initiator assembly operable to activate said first propellant charge, wherein a combustion thereof initiates a combustion of said second propellant charge via said apertures;
a filter abutting said booster cup end surface;
a perforated disc abutting said filter; and
a nozzle positioned at an end of said inflator and abutting said perforated disc for supplying an inflation gas to the inflatable airbelt system."

The remarks set forth with regard to the patentability of claim 1 in response to the rejection under 35 U.S.C. §102(b) over Kirchoff et al. '545 are equally applicable with regard to claim 23, and are incorporated herein by reference as if fully stated. That is, Applicants believe that Kirchoff et al. '545 does not teach an inflator including ***both*** "a plurality of apertures formed in said outer peripheral wall...," of a booster cup and "an initiator assembly operable to activate said first propellant charge" as recited in claim 23 of the present application.

As stated previously, there is no teaching or suggestion in Kirchoff et al. '545 that either squib 19 or squib 20 would rupture tube 34 so as to produce "a plurality of apertures" in the wall of tube 34. As is known in the art, in the absence of features (such as scoring, notches, or the like) designed to promote failure of the tube wall at predetermined points, the location (or locations) at which the tube ruptures will be determined by such factors as the locations along the length of the tube at which the tube is externally supported, the presence and locations of any inherent material weaknesses or structural weaknesses in the tube wall, the strength of any seals or connections between the tube and other portions of the gas generator interior, and the pressure distribution within the tube. Kirchoff et al. '545 discloses no inherent structural or surface features that would provide one or more predetermined failure points in tube 34.

The only indication of desired failure points along tube 34 is provided by the positioning of squibs 19 and 20 within the tube. As stated in column 2, lines 66-68, continuing through to column 3, line 1 of the reference:

"Each chamber 16 and 17 is further equipped with an electric squib 19 and 20, respectively, surrounded by a pyrotechnic material 21."

The only portion of the reference that *explicitly* discusses the rupturing of tube 34 is found in column 3, lines 54-63, continuing through to column 4, line 1:

"Hence, in the event that a collision is of the low level type, wherein only the downstream squib 20 is ignited by an electric signal, the heat from the burning gas generant 18 in the downstream chamber 17 will

be rapidly transmitted through the wall of the tube 34 to ignite the pyrotechnic material 21 that is associated with the upstream squib 19. The squib 19 and its pyrotechnic material 21 will then rupture the wall of the tube 34 to ignite the gas generant material 18 in the upstream chamber 16. This causes a somewhat slower delivery of gases to an inflatable structure than in the case of a high-level impact wherein both squibs are fired simultaneously."

Thus, each of squibs 19 and 20 is positioned to ignite an associated gas generant positioned in one of chambers 16 and 17. That is, squib 19 is positioned to ignite the gas generant in chamber 16 when activated, and squib 20 is positioned to ignite the gas generant in chamber 17 when activated.

In order to ignite the gas generant in chamber 17, activation of squib 20 produces a localized pressure surge in the portion of the tube proximate the squib, causing tube 34 to rupture in the vicinity of squib 20, so that the resulting combustion products would exit tube 34 and ignite gas generant 18 positioned in chamber 17. Similarly, in order to ignite the gas generant in chamber 16, activation of squib 19 causes tube 34 to rupture in the vicinity of squib 19, so that the resulting combustion products would exit tube 34 and ignite gas generant 18 positioned in chamber 16. Thus, the only express or implied disclosure relating to the rupture of tube 34 relates to the *positions or regions* along the length of the tube where the tube ruptures, and not to whether "a plurality of apertures" are formed in any particular rupture region. Therefore, the only point in time at which the reference even implies that tube 34 has a *plurality* of ruptures formed therein is after *both* of squibs 19 and 20 have been activated. However, at this point in time, the gas generator described in Kirchoff et al. '545 does not include "...an initiator assembly operable to activate said first propellant charge.." because, at this point in time, both squibs have been fired and neither squib is operable to activate anything.

In view of the above, the disclosure of Kirchoff et al. '545 does not teach an inflator including ***both*** "a plurality of apertures formed in said outer peripheral wall," and "an initiator assembly operable to activate said first propellant charge" as recited in claim 23 of the present application.

In contrast, claim 23 of the present application affirmatively recites "a plurality of apertures formed in said outer peripheral wall" of the booster cup. The "plurality of apertures" exists in the wall of the booster cup *simultaneously with* "...an initiator assembly *operable to activate* said first propellant charge..." Furthermore, the *simultaneous existence* in the inflator of the present invention of "a plurality of apertures formed in said outer peripheral wall and "an initiator assembly operable to activate said first propellant charge" is explicit, or at the very least inherent, in the language of claim 23.

Furthermore, Kirchoff et al. '545 does not teach an inflator including a single filter which abuts ***both*** a booster cup end surface *and* a perforated disc which, in turn, abuts a nozzle "positioned at an end of said inflator... for supplying an inflation gas to the inflatable airbelt system"as set forth in claim 23. As stated previously, Applicants believe that the gas generator of Kirchoff et al. '545 incorporates *two separated* filter assemblies, rather than a *single* filter as disclosed in the present invention. In the reference, filtering screens 22 and coarse screen 24 combine to form a first filter assembly, and cooling means 29 and 30 combine to form a second filter assembly. As stated in column 3, lines 9-28 of the reference:

> "A plurality of layers of filtering screens 22, comprising relatively fine wire screen (about 30 to 60 mesh) is adjacent the end of the container 14 and is retained in place by a first perforated plate 23 having the same diameter as the inside of the housing 6. A spacing means consisting of a plurality of layers of coarse screen 24 (about 8 to 16 mesh) separates the filtering screens 22 from the perforated plate 23 to provide a free-flow volume of space for gases that may emerge from the container 14 when the gas generant material 18 is fired. *A plastic-film bag 25, containing a pH neutralizing material 26 is retained in a position adjacent the first perforated plate 23 by a second perforated plate 27. A preferred pH neutralizing material 26 is powdered iron sulfate, Fe.sub.2 $(SO_4)_3$ or $FeSO_4$.* A cooling means 28 is made in two sections, the first section 29 comprises a plurality of layers of coarse wire screen similar to the spacing means 24, and the second section 30 comprising a plurality of layers of fine wire screen similar to the filtering screens 22." (emphasis added)

Thus, the two filter assemblies described above are separated by a plastic-film bag 25 containing a pH neutralizing material 26 and retained in a position adjacent a first perforated plate 23 by a second perforated plate 27. This neutralizing material 26 is *not* a filter, but rather is provided and positioned to induce a neutralizing chemical treatment of the effluent exiting screens 24, to reduce the pH of the effluent. All effluent exiting the screens 24 *must* pass through neutralizing material 26 before passing to cooling means 29 and 30 for cooling and/or further filtering. Thus, neutralizing material 26 is not a filter but rather *separates* the two filter assemblies formed by screens 22, 24 and cooling means 29, 30.

As the two filter assemblies described in the reference are separated by pH neutralizing material 26, *neither* of the filter assemblies (comprising screens 22, 24 and cooling means 29, 30) include all of the above-mentioned features recited in claim 23. That is, neither filter abuts ***both*** a booster cup end surface *and* a perforated disc which, in turn, abuts a nozzle "positioned at an end of said inflator... for supplying an inflation gas to the inflatable airbelt system "as set forth in claim 23.

Furthermore, Kirchoff et al. '545 discloses no operational mode in which a plurality of apertures is formed in an outer peripheral wall of a booster cup, *and* in which an initiator assembly is operable to activate a propellant charge contained within the booster tube. The operational modes of the gas generator of Kirchoff et al. '545 are described in column 3, lines 34-63, continuing through column 4, lines 1-4:

> "When the vehicle, in which the present invention is installed, collides with some other object, sensing devices, not a part of the present invention, deliver an electric signal. This signal or signals will then cause one or both electric squibs 19 and 20 to be fired. If the impact is severe, both squibs will be fired simultaneously for maximum effectiveness in delivering gases to the inflatable structure with maximum speed. However, if the impact is less severe, only the downstream squib 20 will be fired. In the latter case, *combustion will proceed upstream through the partition 15 to ignite the squib 19 and the gas generant 18 in the upstream chamber 16.* This provides a slower rate of inflation to provide a softer cushioning effect, but with the same quantity of gas.
>
> It will be noted that the pyrotechnic material 21 that is contiguous with the upstream squib 19 extends well into the downstream gas generant chamber 17 via the tube 34 that holds both squibs 19 and 20 and the associated pyrotechnic materials 21. This tube 34 is made of very thin (about 5 mils) aluminum. Hence, in the event that a collision is of the low level type, wherein *only the downstream squib 20 is ignited by an electric signal, the heat from the burning gas generant 18 in the downstream chamber 17 will be rapidly transmitted through the wall of the tube 34 to ignite the pyrotechnic material 21 that is associated with the upstream squib 19. The squib 19 and its pyrotechnic material 21 will then rupture the wall of the tube 34 to*

> *ignite the gas generant material 18 in the upstream chamber 16.* This causes a somewhat slower delivery of gases to an inflatable structure than in the case of a high-level impact wherein both squibs are fired simultaneously." (emphasis added)

Thus, the reference discloses two operational modes for the device described therein. In a first mode, both squibs are activated simultaneously, producing rupture of tube 34. But, as stated previously, *after* the tube has been ruptured, neither of squibs 19 and 20 is operable to activate a propellant charge contained within the tube. In a second mode (designed for low-level collision), squibs 19 and 20 are activated sequentially; however, only downstream squib 20 is activated by an electrical signal. As explained in the above portions of Kirchoff et al. '545, when only the downstream squib 20 is ignited by an electric signal, the heat from the burning gas generant 18 in the downstream chamber 17 will be transmitted through the wall of the tube 34 to ignite the pyrotechnic material 21 that is associated with the upstream squib 19. The squib 19 and its pyrotechnic material 21 will then rupture the wall of the tube 34 to ignite the gas generant material 18 in the upstream chamber 16. The plain language of claim 1 of Kirchoff et al. '545 makes this clear:

> "1. In a gas generator for delivering gas to an inflatable structure in response to a sensor, said generator including a housing having an outlet orifice in communication with said inflatable structure, a gas generant material in said housing, and filtering and cooling means between said gas generant material and said orifice, the improvement comprising: a consumable partition dividing said gas generant material into first and second portions; a first electric-initiated igniter adjacent said first portion for igniting it in response to any signal from said sensor; a second electric-initiated igniter adjacent said second portion for igniting it in response to only a high-level signal from said sensor, said second igniter extending through said partition from said second portion into said first portion, *whereby said second igniter may be ignited either simultaneously with said first igniter in response to said high-level signal, or sequentially, with respect to said first igniter, by the heat of combustion from said first portion.*" (emphasis added)

Thus, in the sequential mode of operation, *upstream squib 19 is activated by combustion of the pyrotechnic material 21 associated with the squib*, rather than combustion of the pyrotechnic material 21 being initiated by squib 19. Therefore, in the mode of operation in which squibs 19 and 20 are activated sequentially, squib 19 is not operable to activate a propellant charge 21 positioned within tube 34, *because combustion of the propellant charge 21 is designed to produces activation of the squib.* Thus, as squib 19 is inoperable to activate a propellant charge within tube 34 even after activation of squib 20 and any resulting rupture of tube 34 in the vicinity of squib 20, the device disclosed in Kirchoff et al. '545 cannot simultaneously include **both** "...a plurality of apertures formed in said outer peripheral wall" and "...an initiator assembly operable to activate said first propellant charge" as set forth in claim 23 of the present application. In consequence, neither of the operational modes disclosed provides a device in which ***both*** a plurality of apertures is formed in an outer peripheral wall of a booster cup, *and* in which an initiator assembly is operable to activate a propellant charge contained within the booster tube.

In addition, even assuming that activation of downstream squib 20 would produce multiple ruptures in tube 34, and even assuming that upstream squib 19 could be considered operable to activate a pyrotechnic

material 21 contained in tube 34 after activation of downstream squib 20, all of the elements of claim 23 would not be met by Kirchoff et al. '545. During sequential operation of squibs 19 and 20, squib 20 activates first, producing a rupture of tube 34 in the vicinity of squib 20, resulting in the combustion of the gas generant contained in chamber 17. For claim 23 to be anticipated by Kirchoff et al. '545, combustion of the pyrotechnic material 21 adjacent upstream squib 19 would have to initiate combustion of the associated gas generant in chamber 18 (the only gas generant remaining in either of chambers 17 and 18 after combustion of the generant in chamber 17) *via the rupture already formed proximate squib 20 and leading into chamber 17*. For this to occur, combustion products resulting from activation of squib 19 and combustion of pyrotechnic material adjacent the squib would have to flow out of tube 34, through the rupture created by activation of squib 20, into chamber 17, then into chamber 16 to activate the gas generant positioned there. However, this sequence cannot occur. Viewing the drawing in Kirchoff et al. '545, it is clear that a separator is provided at the base of squib 20 which divides the interior of tube 34 into two separate regions. It is also clear that any rupture in tube 34 due to the activation of squib 20 will occur proximate squib 20 and to the right of the separator. Thus, due to the presence of the separator, combustion products resulting from activation of squib 19 and the burning of pyrotechnic material 21 on the *left* side of the separator are unable to reach any rupture created by squib 20 on the *right* side of the separator. For this reason, Kirchoff et al. '545 does not teach an inflator wherein a "...booster cup includes a plurality of apertures formed in said outer peripheral wall..." and further including "...a first propellant charge positioned in said booster cup, a second propellant charge positioned in said inflator body..." and "...an initiator assembly operable to activate said first propellant charge, wherein a combustion thereof initiates a combustion of said second propellant charge via said apertures..." as recited in claim 23 of the present application.

Kirchoff et al. '545 also does not teach in inflator including all of the following elements recited in claim 23 of the present application:

> "...an initiator assembly operable to activate said first propellant charge, wherein a combustion thereof initiates a combustion of said second propellant charge via said apertures..."

As noted previously, the only point in time at which the reference even implies the existence of *multiple* ruptures in tube 34 is *after* the activation of both squib 19 and squib 20. Also, as noted previously, after both of squibs 19 and 20 have been activated, neither squib is operable to activate a propellant charge contained in tube 34. However, during sequential operation of squibs 19 and 20, even if upstream squib 19 were considered to be operable to activate pyrotechnic material 21 surrounding the squib, combustion of the gas generant in chamber 16 associated with squib 19 would not "...initiate *a combustion of said second propellant charge via said apertures* ..." as recited in claim 23 of the present application. Where squibs 19 and 20 are operated sequentially, downstream squib 20 activates first, to initiate combustion of the gas generant contained in chamber 17. Therefore, it is squib 20 which *initiates* combustion of a second propellant charge in the gas generator. Also, even if the gas generant contained in chamber 16 could be considered to be equivalent to "the

second *propellant charge" set forth in claim 23,* squib 19 is incapable of initiating combustion of the gas generant in chamber 16 via a rupture produced by the activation of squib 20, as explained above.

For the reasons set forth above, Kirchoff et al. '545 does not show or suggest all of the elements recited in claim 23 of the present application. In addition, the Examiner concedes that "Schneider et al. do not specifically disclose all of the interior features of the inflator, such as a booster cup, apertures, propellant charge, filter, or nozzle member." (Paper no. 20061004, page 6). Thus, even if the references were combined, no combination of the references would provide all of the features recited in claim 23. Thus, a prima facie case for obviousness of claim 23 in view of the cited references has not been established. For these reasons, the rejection of claim 23 under 35 U.S.C. 103(a) in view of the cited references should be reversed and claim 23 allowed.

CLAIM 24

Claim 24 recites:

"24. The airbelt system of claim 23 wherein said booster cup is an elongate substantially cylindrical member oriented substantially coaxially with said inflator body."

As claim 24 depends from independent claim 23, the remarks set forth with regard to the patentability of claim 23 in response to the rejection under 35 U.S.C. §103(a) in view of Schneider et al. '945 and Kirchoff et al. '545 are equally applicable with regard to the rejection of claim 24, and are incorporated herein by reference as if fully stated. Also, as stated previously, a prima facie case of obviousness of claim 23 in view of the cited references has not been established. In addition, if an independent claim is nonobvious under **35 U.S.C. 103**, then any claim depending therefrom is nonobvious. In re Fine, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). Thus, as claim 23 is deemed nonobvious, and as claim 24 depends from claim 23, claim 24 should also be deemed nonobvious. For these reasons, the rejection of claim 24 under 35 U.S.C. 103(a) in view of the cited references should be reversed and claim 24 allowed.

CLAIM 25

Claim 25 recites:

"25. The airbelt system of claim 24 wherein said inflator body includes an inner peripheral wall spaced from said outer peripheral wall of said booster cup by an annular space;
said second propellant charge positioned in said space."

As claim 25 depends from independent claim 23, the remarks set forth with regard to the patentability of claim 23 in response to the rejection under 35 U.S.C. §103(a) in view of Schneider et al. '945 and Kirchoff et al. '545 are equally applicable with regard to the rejection of claim 25, and are incorporated herein by reference as if fully stated. Also, as stated previously, a prima facie case of obviousness of claim 23 in view of the cited

references has not been established. In addition, if an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. In re Fine, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). Thus, as claim 23 is deemed nonobvious, and as claim 25 depends from claim 23, claim 25 should also be deemed nonobvious. For these reasons, the rejection of claim 25 under 35 U.S.C. 103(a) in view of the cited references should be reversed and claim 25 allowed.

CLAIM 26

Claim 26 recites:

"26. The airbelt system of claim 23 wherein said filter constrains said second propellant charge in said space."

As claim 26 depends from independent claim 23, the remarks set forth with regard to the patentability of claim 23 in response to the rejection under 35 U.S.C. §103(a) in view of Schneider et al. '945 and Kirchoff et al. '545 are equally applicable with regard to the rejection of claim 26, and are incorporated herein by reference as if fully stated. Also, as stated previously, a prima facie case of obviousness of claim 23 in view of the cited references has not been established. In addition, if an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. In re Fine, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). Thus, as claim 23 is deemed nonobvious, and as claim 26 depends from claim 23, claim 26 should also be deemed nonobvious. For these reasons, the rejection of claim 26 under 35 U.S.C. 103(a) in view of the cited references should be reversed and claim 26 allowed.

For the above-stated reasons, the Examiner has simply not established that claims 1-7, 9-21, and 27-34 are anticipated by Kirchoff et al. '545. Thus, the §102(b) rejections of independent claim 1 and its dependent claims 2-6, of independent claim 7 and its dependent claims 9- 13, of independent claim 14 and its dependent claims 15-21, independent claim 27 and its dependent claims 28-29, and of independent claim 30 and its dependent claims 31-34 as being anticipated by Kirchoff et al. '545 are incorrect and should be reversed.

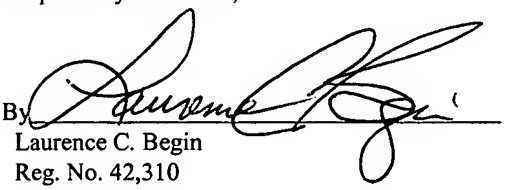
Also, the Examiner has simply not met the burden of establishing a prima facie case of obviousness relative to claims 14 and 22-26 in view of Schneider et al., U.S. Patent No. 6,279,945 and Kirchoff et al. '545. Thus, the §103(a) rejections of independent claim 14 and its dependent claim 22, and of independent claim 23 its dependent claims 23-26 are incorrect and should be reversed.

Accordingly, reversal of the Examiner's rejections of claims 1-7 and 9-34 and issuance of the present application is courteously solicited.

For the reasons stated, the Applicant traverses the rejections as discussed herein, and courteously solicits allowance of the claims, and passage of the subject application to issue.

Submitted herewith is a credit card authorization sheet to charge the amount of $500 to cover the cost of filing this brief in support of the appeal. The Commissioner is authorized to charge any deficiencies (or credit any overage) related to this paper to deposit account no. 50-3238.

Respectfully submitted,

By 

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(viii) Claims Appendix

1. An inflator comprising:

an inflator body;

a substantially cylindrical booster cup extending in said body, said booster cup having an outer peripheral wall and an end surface extending radially inwardly from said wall;

a plurality of apertures formed in said outer peripheral wall;

a first propellant charge positioned in said booster cup;

a second propellant charge positioned in said inflator body;

an initiator assembly operable to activate said first propellant charge, wherein a combustion thereof initiates a combustion of said second propellant charge and ejection of an inflation gas from said inflator body;

a filter abutting said booster cup end surface;

a perforated disc abutting said filter; and

a nozzle positioned at an end of said inflator and abutting said perforated disc for supplying an inflation gas to an inflatable restraint system.

2. The inflator of claim 1 wherein said inflator body comprises an inner peripheral wall separated from said outer peripheral wall by a substantially annular space; and

said second propellant charge is positioned in said space.

3. The inflator of claim 2 wherein said second propellant charge is positioned substantially adjacent said outer peripheral wall.

4. The inflator of claim 3 wherein said second propellant charge comprises a plurality of propellant tablets.

5. The inflator of claim 3 wherein said second propellant charge substantially fills the space between the outer peripheral wall and the inner peripheral wall of the inflator body.

6. The inflator of claim 5 wherein said filter constrains said second propellant charge in said space.

7. An inflator for an inflatable restraint system in a vehicle comprising:

an inflator body having first and second ends and an inner peripheral wall;

a booster cup extending in said body and having an outer peripheral wall and an end surface extending inwardly from said outer peripheral wall, said booster cup having a first propellant charge positioned therein;

said inner peripheral wall and said outer peripheral wall are separated by a substantially annular space having a second propellant charge positioned therein;

an initiator assembly disposed proximate said first end and operable to ignite said first propellant charge;

a filter abutting said booster cup end surface;

a perforated disc abutting said filter; and

a nozzle positioned at said second end of said body and abutting said perforated disc, said nozzle defining a nozzle outlet for supplying an inflation gas to the inflatable restraint system.

9. The inflator of claim 7 wherein said body has a total length and an area defined by a cross-section thereof, and said filter has a given length about one-fourth to one-half of the total length of the body, said filter occupying a volume determined by multiplying the cross-section of said body by the length of said filter.

10. The inflator of claim 7 wherein said booster cup is a substantially cylindrical elongate member substantially coaxial with said inflator body.

11. The inflator of claim 10 wherein said booster cup includes a plurality of apertures formed in said outer peripheral wall.

12. The inflator of claim 11 wherein said substantially annular space extends longitudinally in said inflator body from a point proximate said first end up to a point substantially coplanar with said end surface.

13. The inflator of claim 7 wherein said filter is substantially cylindrical and includes a substantially cylindrical periphery positioned adjacent said inner peripheral wall, and a substantially planar end positioned flush with said end surface.

14. An inflatable restraint system for a motor vehicle comprising:

an inflatable restraint device;

an inflator operable to provide an inflation gas to said inflatable restraint device, said inflator comprising an elongate substantially cylindrical inflator body having first and second ends and an inner peripheral wall;

an elongate booster cup mounted to said inflator body proximate said first end and extending substantially coaxially therewith, said booster cup having an outer peripheral wall separated from said inner peripheral wall by an annular space, and a plurality of apertures formed in said outer peripheral wall;

a propellant charge positioned in said space;

a filter positioned in said inflator body abutting an end portion of the booster cup , said filter securing said propellant charge in said space;

a perforated disc abutting said filter; and

a nozzle member proximate said second end of said inflator body and abutting said perforated disc, said nozzle member constraining said filter against axial displacement.

15. The inflatable restraint system of claim 14 wherein said propellant charge comprises a plurality of gas generant tablets positioned in a geometrically ordered fashion in said annular space.

16. The inflatable restraint system of claim 15 wherein said propellant charge comprises a plurality of gas generant tablets stacked adjacently in said annular space and having cylindrical axes oriented substantially perpendicular said inner peripheral wall.

17. The inflatable restraint system of claim 14 wherein said nozzle is threadedly engaged with said inflator body.

18. The inflatable restraint system of claim 14 wherein said filter is secured against said booster cup, thereby constraining said tablets from movement in said annular space.

19. The inflatable restraint system of claim 14 further comprising a propellant charge positioned in said booster cup.

20. The inflatable restraint system of claim 14 further comprising an initiator body within said inflator body proximate said first end;

wherein said booster cup is attached to said initiator body and suspended therefrom, said booster cup supported in said inflator body solely by said attachment with said initiator body.

21. The inflatable restraint system of claim 14 wherein the inflatable restraint device is an airbag.

22. The inflatable restraint system of claim 14 wherein the inflatable restraint device is an airbelt.

23. An inflatable airbelt system for a motor vehicle comprising:

an inflatable airbelt;

an inflator operable to provide an inflation gas to said airbelt, said inflator comprising an inflator body and a booster cup extending in said body, said booster cup having an outer peripheral wall and an end surface extending radially inwardly from said wall;

said booster cup includes a plurality of apertures formed in said outer peripheral wall;

a first propellant charge positioned in said booster cup;

a second propellant charge positioned in said inflator body;

an initiator assembly operable to activate said first propellant charge, wherein a combustion thereof initiates a combustion of said second propellant charge via said apertures;

a filter abutting said booster cup end surface;

a perforated disc abutting said filter; and

a nozzle positioned at an end of said inflator and abutting said perforated disc for supplying an inflation gas to the inflatable airbelt system.

24. The airbelt system of claim 23 wherein said booster cup is an elongate substantially cylindrical member oriented substantially coaxially with said inflator body.

25. The airbelt system of claim 24 wherein said inflator body includes an inner peripheral wall spaced from said outer peripheral wall of said booster cup by an annular space;

said second propellant charge positioned in said space.

26. The airbelt system of claim 23 wherein said filter constrains said second propellant charge in said space.

27. An inflator module for a vehicle occupant protection system comprising:

a module housing;

an inflator positioned in said housing, said inflator comprising a booster cup mounted to [[said]] an inflator body and extending substantially coaxially therewith, said booster cup having an outer peripheral wall partially defining an annular space and a plurality of apertures formed in said outer peripheral wall;

a propellant charge positioned in said space;

a filter positioned in said inflator abutting an end portion of said booster cup for securing said propellant charge in said space;

a perforated disc abutting said filter; and

a nozzle positioned at an end of said inflator and abutting said perforated disc for supplying an inflation gas to the inflatable vehicle occupant protection system.

28. The inflator module of claim 27 wherein said inflator comprises an inflator body having an inner peripheral wall opposing said outer peripheral wall, said inner and outer peripheral walls defining said space.

29. The inflator module of claim 28 wherein said filter member constrains said propellant charge in said space.

30. A method of manufacturing a gas generator comprising the steps of:

positioning a booster cup within an elongate substantially cylindrical inflator body;

placing a propellant charge in a space extending between an outer peripheral wall of the booster cup and an inner peripheral wall of the inflator body;

inserting a filter member into the inflator body up to a point at which the filter bears against an end surface of the booster cup;

positioning a perforated disc abutting said filter; and

positioning a nozzle member in the inflator body at a selected axial position and abutting said perforated disc such that the filter is constrained from axial movement between the nozzle member and the booster cup, whereby the filter secures the propellant charge in the space.

31. The method of claim 30 wherein the step of placing a propellant charge in the space comprises placing propellant tablets therein.

32. The method of claim 31 wherein the step of placing the propellant charge in the space comprises placing the propellant tablets therein in a geometrically ordered fashion up to a point substantially coplanar with an end surface of the booster cup.

33. The method of claim 30 wherein the filter length is sized to reduce or increase a gas pressure resulting from activation of the gas generator.

34. A gas generator manufactured according to the method of claim 30.

(ix) Evidence Appendix

Appendix A: Application Serial No. 10/826,437, filed on April 16, 2004

Appendix B: First Office Action (paper no. 20060421), mailed May 4, 2006

Appendix C: Cited References:

1) Kirchoff et al., U.S. Patent No. 3,972,545

2) Schneider et al., U.S. Patent No. 6,279,945

Appendix D: Amendment "A", filed August 4, 2006

Appendix E: Final Office Action (paper no. 20061004), mailed October 16, 2006

Appendix F: Amendment After Final Office Action Under 37 CFR § 1.116, filed February 15, 2007

Appendix G: Examiner's Advisory Action (paper no. 200701226) mailed January 25, 2007

(x) Related Proceedings Appendix

NONE

Appendix A

Application Serial No. 10/826,437, filed on April 16, 2004

BELT AND SIDE IMPACT INFLATOR

TECHNICAL FIELD

The present invention relates generally to gas generator devices for inflatable restraint systems in automobiles, and relates more particularly to a belt and side impact inflator having a unique booster cup design and method of assembly.

BACKGROUND OF THE INVENTION

Inflatable restraint systems or "airbag" systems have become a standard feature in most new vehicles. These systems have made significant contributions to automobile safety; however, as with the addition of any standard feature, they increase the cost, manufacturing complexity and weight of most vehicles. Technological advances addressing these concerns are therefore welcomed by the industry. In particular, the gas generator or inflator used in many occupant restraint systems tends to be the heaviest, most complex component. Thus, simplifying the design and manufacturing of airbag inflators, while retaining optimal function, has long been a goal of automotive engineers.

Typical inflators are constructed having an elongate metallic body. Because many inflators utilize pyrotechnic gas generant compounds to produce inflation gas for the associated airbag, the inflator structure is necessarily robust, making such inflators correspondingly heavy. The long term success of driver-side and passenger side inflatable restraint systems has prompted automotive manufacturers to increasingly investigate and implement side impact inflatable restraints, as well as inflatable airbelts. Because the inflatable systems are typically mounted in the vehicle roof pillars, doors or seats, mounting space can be at a premium. Moreover, coupled with inherent difficulties in engineering inflators capable of producing the relatively small, punctuated inflation charges typical of side impact airbags and airbelts, such systems present a unique set of challenges to designers. Engineers have developed numerous designs for optimizing weight, operation and assembly; however, the pressure to downsize components and reduce manufacturing challenges continues to be acute.

Accompanying the need for ever simpler and more elegant designs is the desirability of inflators that are relatively robust yet capable of reliable operation even after storage periods of several years. One problem in particular associated with

long periods between installation in a vehicle and activation of the inflator relates to mechanical degradation of the gas generant or propellant material. Many gas generants are provided in a solid, typically tablet form. Jostling of the propellant within the inflator can have the undesirable effect of breaking or crumbling the propellant tablets, reducing their efficacy in some cases. Various spring-biased mechanisms for constraining movement of the propellant tablets have been proposed; however, these systems tend to increase manufacturing complexity and cost, and add extra components to the inflator, adding to the weight of the system.

SUMMARY OF THE INVENTION

In one aspect, the present invention provides an inflator for an inflatable restraint system in a vehicle. The inflator preferably includes an elongate substantially cylindrical inflator body having first and second ends and an inner peripheral wall. A booster cup is positioned within the inflator body and preferably extends substantially coaxially with the body, defining a combustion chamber therebetween.

In another aspect, the present invention provides an airbag module, preferably having an inflator with an elongate substantially cylindrical inflator body having first and second ends and an inner peripheral wall. A booster cup is positioned within the inflator body and preferably extends substantially coaxially with the body, defining a combustion chamber between the body and the cup.

In still another aspect, the present invention provides a vehicle occupant protection system, preferably having an inflator with an elongate substantially cylindrical inflator body with first and second ends and an inner peripheral wall. A booster cup is positioned within the inflator body and preferably extends substantially coaxially with the body, defining a combustion chamber between the body and the cup. The inflator is operable to provide an inflation gas to an inflatable restraint device such as an airbag or airbelt.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is an elevational view of an airbelt inflator according to a preferred embodiment of the present invention;

Figure 2 is a sectioned side view of an airbelt inflator similar to the inflator of Figure 1;

Figure 3 is a partial schematic view of an airbag module and airbag;

Figure 4 is a partial view of a vehicle occupant protection system in a motor vehicle;

Figure 5 is a partial view of a vehicle occupant protection system in a motor vehicle.

Figure 6 is a sectional view taken along the line A-A of Figure 2.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Referring to Figure 1, there is shown an elevational view of an airbelt inflator 10 according to a preferred constructed embodiment of the present invention. Inflator 10 is preferably a single stage device designed primarily for supplying and directing gas from the combustion of pyrotechnic gas generant materials into an inflatable vehicle safety airbelt, but is not limited to such an application. Exemplary, but not limiting airbelts and/or vehicle occupant protection systems are described in U.S. Patent Nos. 6,116,137, 6,170,863, 6,145,873, 6,142,512, and 6,523,856, herein incorporated by reference. Inflator 10 may be manufactured entirely from known materials and by known processes.

Turning to Figure 2, there is shown a sectioned side view of an inflator 10, similar to the inflator of Figure 1. Inflator 10 includes a substantially cylindrical inflator body 12, having a first end 11 and a second end 13. An initiator assembly 14 is positioned within first end 11, and is preferably secured therein by crimping inflator body 12 in a conventional manner. Initiator assembly 14 includes an initiator body 15 with an attached igniter or squib 16. It should be appreciated that some other attachment method such as mating threads or a snap-fit or press-fit connection could be used rather than a crimp to hold initiator assembly 14 in place. An O-ring 40, preferably a conventional elastomeric O-ring, preferably encircles initiator body 15, and fluidly seals first end 11 of inflator body 12. The igniter 16 has a set of electrical contacts 20, preferably accessible from first end 11. Igniter 16 may be any suitable known igniter, for instance, the igniter taught in U.S. Patent No. 5,934,705, herein incorporated by reference, and is preferably connected to an automobile electrical system whereby it can be activated in a conventional manner.

A unique booster cup 22 is positioned within inflator body 12, and is preferably press fit with initiator body 15, suspending cup 22 within inflator body 12. Booster cup 22 includes an end surface 29 that extends radially inwardly, or

substantially orthogonally to a longitudinal axis of the body 12, and is preferably substantially planar. A booster charge 18 is preferably positioned in booster cup 22, and is ignitable with igniter 16, activating inflator 10 in a conventional manner. In addition, an autoignition tablet 19 may be placed in booster cup 22 (or elsewhere in inflator 10), and can be ignited at an elevated temperature, in a manner well known in the art. A plurality of apertures 24 are preferably positioned around booster cup 22, and preferably spaced along the length thereof. Apertures 24 can fluidly connect the interior of cup 22, a first combustion chamber, with a second or main combustion chamber 26, within which the main gas generant charge 28 is positioned. Main chamber 26 is bounded at an outside by an inner peripheral wall 25 of inflator body 12, and on an inside by an outer peripheral wall 27 of cup 22. The main gas generant charge 28 may be any suitable propellant known in the art, and preferably consists of a non-azide propellant in tablet form. Exemplary, but not limiting compositions are described in U.S. Patent Nos. 5,035,757, 5,872,329, 5,756,929, and 5,386,775, herein incorporated by reference.

Various foils or similar materials may be placed over apertures 24 to seal the interior of cup 22 from main chamber 26, facilitating more robust burning of booster charge 18 in some instances, by allowing cup 22 to accommodate a resident interim gas pressure, in a manner known in the art. Sealing the contents of cup 22 from the outside environment also helps protect against degradation of the propellant. In a particularly preferred embodiment cup 22 extends approximately one half of a length of inflator body 12. Main propellant charge 28 preferably substantially fills chamber 26 and the tablets 28 are positioned in a geometrically ordered fashion inside chamber 26 such that they fill the space substantially uniformly. One preferred embodiment includes a plurality of substantially cylindrical tablets having their cylindrical axes (not shown) oriented substantially perpendicular to walls 25 and 27.

A cylindrical filter 38, preferably a metallic mesh filter, is positioned in inflator body 12, and filters particulate materials generated by the combustion of propellant charges 18 and 28. Filter 38 fills a volume of the housing 12 defined by the cross-section of filter 38 (shown in Figure 6) spanning from a point l_1 to a second point l_2. The longitudinal distance defined by the distance between l_1 and l_2 ranges from about one-fourth to one half of the total length of housing 12, or l_T. Adjustment of the length of the filter 38 therefore increases or reduces the pressure of the gas at the second end 13 and as such,

may function as a filter, a gas pressure throttle, and/or a heat sink depending on design criteria. Suitable, exemplary filters are available from Wayne Wire of Kalkaska, Michigan. Filter 38 also serves as a heat sink for hot combustion gases produced during inflator activation, cooling the gases before their ejection into the associated airbelt or airbag. In a preferred embodiment, a perforated disc 30, preferably an expanded metal, is positioned adjacent filter 38, and facilitates the creation of a resident interim gas pressure in inflator body 12 during combustion of the propellant. A nozzle 36 is preferably positioned adjacent disc 30 and secured with inflator body 12 by crimping second end 13, although the nozzle 36 might be threadedly attached to inflator body 12 if desired. An O-ring 39 is preferably circumferential about a portion of nozzle 36, and thereby creates a fluid-tight seal at second end 13. In a preferred embodiment, nozzle 36 includes a substantially cylindrical projection 37 that extends past second end 13. An internally projecting ledge 38 is preferably positioned within nozzle 36, and preferably includes a central aperture 40, that may be covered by a conventional burst shim (not shown).

In a preferred embodiment, inflator 10 is assembled by serially positioning the interior components in an innermost to outermost fashion, i.e. inserting those components adjacent first end 11 first, then placing the various additional components into the inflator body in order, and lastly sealing second end 13. A variety of different nozzles giving inflator 10 varying gas output characteristics can be utilized with inflator 10. For example, where it is desirable to provide a "thrusting" inflator, the nozzle 36 as pictured in Figure 2 might be utilized. Such a design results in a relatively narrow or smaller "plug" of a directed pulse of gas from inflator 10 during activation. Moreover, by restricting the diameter through which the gas is ejected from the inflator, a relatively greater thrust is imparted to the exiting gas per unit time. In contrast, where a thrust-neutral inflator is desirable, or where greater relative outward spreading of the gas discharging from inflator 10 is desired, a different nozzle can be used. For instance, a nozzle might be used having a greater number of apertures for discharging gas, or apertures that are spaced or otherwise designed to allow a more gradual exit of the gas, or more outward directing of the gas. Similarly, the extension 37 might be flared outwardly to assist in outwardly directing the discharging gas. Inflator 10 can be easily converted from a thrusting to a non-thrusting inflator by changing the nozzle used therewith.

Other advantages of the presently disclosed design result from the unique booster cup design. In a preferred embodiment, booster cup 22 is sized such that it extends into inflator body 12, and abuts filter 38, thereby serving as a locator for filter 38, and providing a relatively snug packing arrangement for propellant tablets 28. Thus, cup 22, inflator body 12, filter 38 and initiator body 15 define chamber 26, and securely retain tablets 28 therein, preventing their being crushed by the igniter, filter, and other components during assembly and thereafter during storage of inflator 10. In addition, the booster cup design results in relatively consistent, repeatable bag performance. The relatively small, lightweight design makes manufacturing of the inflator easier and less expensive. Moreover, lighter weight is often desirable in vehicle inflatable restraint systems.

In the event of an impact, sudden vehicle deceleration, or other appropriate condition, an electrical signal is sent to igniter 16 from an onboard electronic controller (not shown) in a conventional manner. Igniter 16 subsequently ignites the gas generant booster tablets 18 located in cup 22. Ignition of booster tablets 18 creates a flame front that traverses apertures 24, resulting in a relatively rapid ignition of the main charge tablets 28 in cavity 26. Ignition of main charge 22 results in the very rapid creation of combustion gases in inflator body 12, and a consequent very rapid rise in the internal gas pressure in inflator body 12. When the internal gas pressure has risen to a sufficient level, it ruptures the burst shim, foil, etc. placed across aperture 40 (not shown). Thenceforth, the gas flows out nozzle 36 into the associated airbelt or airbag. In a preferred embodiment, inflator 10 is positioned in a vehicle B-pillar, and is operable to direct inflation gas into an inflatable safety restraint belt when activated by a vehicle sensing system. However, inflator 10 might also be positioned in a vehicle C-pillar, or even elsewhere in the vehicle. Furthermore, inflator 10, although especially useful in vehicle airbelts, may also be applicable in other vehicle occupant protection airbag systems. Finally, it is also believed that the present gas generator may be useful in other applications to include inflatable lifeboats and inflatable aircraft exit ramps, for example.

Turning to Figure 3, there is shown a schematic view of a portion of a vehicle occupant protection system 100. System 100 includes a module 160 that houses an inflator 110, for example an inflator similar to those described herein. A wide variety of inflator modules are known in the art. An exemplary, but not limiting module suitable for use in a side impact system in accordance with the present

invention is known from United States Patent No. 6,398,294, hereby incorporated by reference. System 100 further includes an inflatable restraint device 170 that is stored in a folded position within or proximate to module 160. Module 160 and its contents may be located, for example, in a vehicle seat, the side door of a vehicle, or elsewhere. Upon activation of the occupant protection system, inflator 110 is activated to discharge an inflation gas into airbag 170, inflating the same and protecting the vehicle occupant. Referring also to Figure 5, there is shown a similar occupant protection system 300 wherein a module 360, inflator 310 and airbag 370 are mounted in a vehicle side door 380. When it is desirable to activate the occupant protection system an appropriate signal is sent to inflator 310, which subsequently discharges inflation gas into airbag 370, for example via a throat 371. As airbag 370 inflates, it is preferably ejected from an interior of door 380 through a deployment opening 390. In a preferred embodiment airbag 370 displaces or bursts through trim on door 390, allowing airbag 370 to position itself between a vehicle occupant and the door and window of the vehicle.

Referring to Figure 4, there is shown another exemplary occupant protection system 200 wherein an inflatable airbelt 250 is utilized to assist in protecting the vehicle occupant in the event of a crash or sudden deceleration. In the embodiment pictured in Figure 4, an inflator 210, for example similar to the inflators described herein, supplies an inflation gas to airbelt 250 via a gas supply line 251. Inflator 210 may be mounted, for example, in the vehicle seat 252, or it may be mounted at various other locations in the vehicle.

The present description is intended for illustrative purposes only, and should not be construed to limit the breadth of the present invention in any way. Thus, those skilled in the art will appreciate that various modifications, additions, and alterations to the presently disclosed embodiments might be made without departing from the intended spirit and scope of the present invention. Other aspects, features and advantages of the present invention will be apparent upon an examination of the attached drawing Figures and appended claims.

CLAIMS

1. An inflator comprising:

an inflator body;

a substantially cylindrical booster cup extending in said body, said booster cup having an outer peripheral wall and an end surface extending radially inwardly from said wall;

a plurality of apertures formed in said outer peripheral wall;

a first propellant charge positioned in said booster cup;

a second propellant charge positioned in said inflator body;

an initiator assembly operable to activate said first propellant charge, wherein a combustion thereof initiates a combustion of said second propellant charge and ejection of an inflation gas from said inflator body.

2. The inflator of claim 1 wherein said inflator body comprises an inner peripheral wall separated from said outer peripheral wall by a substantially annular space; and

said second propellant charge is positioned in said space.

3. The inflator of claim 2 wherein said second propellant charge is positioned substantially adjacent said outer peripheral wall.

4. The inflator of claim 3 wherein said second propellant charge comprises a plurality of propellant tablets.

5. The inflator of claim 3 wherein said second propellant charge substantially fills the space between the outer peripheral wall and the inner peripheral wall of the inflator body.

6. The inflator of claim 5 comprising a filter constraining said second propellant charge in said space.

7. An inflator for an inflatable restraint system in a vehicle comprising:

an inflator body having first and second ends and an inner peripheral wall;

a booster cup extending in said body and having an outer peripheral wall and an end surface extending inwardly from said outer peripheral wall, said booster cup having a first propellant charge positioned therein;

said inner peripheral wall and said outer peripheral wall are separated by a substantially annular space having a second propellant charge positioned therein;

an initiator assembly disposed proximate said first end and operable to ignite said first propellant charge; and

a nozzle positioned at said second end of said body and defining a nozzle outlet for supplying an inflation gas to the inflatable restraint system.

8. The inflator of claim 7 comprising a filter positioned adjacent said end surface.

9. The inflator of claim 8 wherein said body has a total length and an area defined by a cross-section thereof, and said filter has a given length about one-fourth to one-half of the total length of the body, said filter occupying a volume determined by multiplying the cross-section of said body by the length of said filter.

10. The inflator of claim 7 wherein said booster cup is a substantially cylindrical elongate member substantially coaxial with said inflator body.

11. The inflator of claim 10 wherein said booster cup includes a plurality of apertures formed in said outer peripheral wall.

12. The inflator of claim 11 wherein said substantially annular space extends longitudinally in said inflator body from a point proximate said first end up to a point substantially coplanar with said end surface.

13. The inflator of claim 8 wherein said filter is substantially cylindrical and includes a substantially cylindrical periphery positioned adjacent said inner peripheral wall, and a substantially planar end positioned flush with said end surface.

14. An inflatable restraint system for a motor vehicle comprising:

an inflatable restraint device;

an inflator operable to provide an inflation gas to said inflatable restraint device, said inflator comprising an elongate substantially cylindrical inflator body having first and second ends and an inner peripheral wall;

an elongate combustion cup mounted to said inflator body proximate said first end and extending substantially coaxially therewith, said combustion cup having an outer peripheral wall separated from said inner peripheral wall by an annular space, and a plurality of apertures formed in said outer peripheral wall;

a propellant charge positioned in said space;

a filter in said inflator body and securing said propellant charge in said space;

a nozzle member proximate said second end of said inflator body, said nozzle member constraining said filter against axial displacement.

15. The inflatable restraint system of claim 14 wherein said propellant charge comprises a plurality of gas generant tablets positioned in a geometrically ordered fashion in said annular space.

16. The inflatable restraint system of claim 15 wherein said propellant charge comprises a plurality of gas generant tablets stacked adjacently in said annular space and having cylindrical axes oriented substantially perpendicular said inner peripheral wall.

17. The inflatable restraint system of claim 14 wherein said nozzle is threadedly engaged with said inflator body.

18. The inflatable restraint system of claim 14 wherein said filter is secured against said booster cup, thereby constraining said tablets from movement in said annular space.

19. The inflatable restraint system of claim 14 further comprising a propellant charge positioned in said combustion cup.

20. The inflatable restraint system of claim 14 further comprising an initiator body within said inflator body proximate said first end;

wherein said combustion cup is attached to said initiator body and suspended therefrom, said combustion cup supported in said inflator body solely by said attachment with said initiator body.

21. The inflatable restraint system of claim 14 wherein the inflatable restraint device is an airbag.

22. The inflatable restraint system of claim 14 wherein the inflatable restraint device is an airbelt.

23. An inflatable airbelt system for a motor vehicle comprising:

an inflatable airbelt;

an inflator operable to provide an inflation gas to said airbelt, said inflator comprising an inflator body and a booster cup extending in said body, said booster cup having an outer peripheral wall and an end surface extending radially inwardly from said wall;

said booster cup includes a plurality of apertures formed in said outer peripheral wall;

a first propellant charge positioned in said booster cup;

a second propellant charge positioned in said inflator body;

an initiator assembly operable to activate said first propellant charge, wherein a combustion thereof initiates a combustion of said second propellant charge via said apertures.

24. The airbelt system of claim 23 wherein said booster cup is an elongate substantially cylindrical member oriented substantially coaxially with said inflator body.

25. The airbelt system of claim 24 wherein said inflator body includes an inner peripheral wall spaced from said outer peripheral wall of said booster cup by an annular space;

said second propellant charge positioned in said space.

26. The airbelt system of claim 23 comprising a filter constraining said second propellant charge in said space.

27. An inflator module for a vehicle occupant protection system comprising:

a module housing;

an inflator positioned in said housing, said inflator comprising a combustion cup mounted to said inflator body and extending substantially coaxially therewith, said combustion cup having an outer peripheral wall partially defining an annular space and a plurality of apertures formed in said outer peripheral wall;

a propellant charge positioned in said space;

a filter in said inflator body and securing said propellant charge in said space.

28. The inflator module of claim 27 wherein said inflator comprises an inflator body having an inner peripheral wall opposing said outer peripheral wall, said inner and outer peripheral walls defining said space.

29. The inflator module of claim 28 wherein said inflator includes a filter member positioned adjacent said combustion cup and constraining said propellant charge in said space.

30. A method of manufacturing a gas generator comprising the steps of:

positioning a combustion cup within an elongate substantially cylindrical inflator body;

placing a propellant charge in a space extending between an outer peripheral wall of the combustion cup and an inner peripheral wall of the inflator body;

inserting a filter member into the inflator body up to a point at which the filter bears against an end surface of the combustion cup; and

positioning a nozzle member in the inflator body at a selected axial position such that the filter is constrained from axial movement between the nozzle member and the combustion cup, whereby the filter secures the propellant charge in the space.

31. The method of claim 30 wherein the step of placing a propellant charge in the space comprises placing propellant tablets therein.

32. The method of claim 31 wherein the step of placing the propellant charge in the space comprises placing the propellant tablets therein in a geometrically ordered fashion up to a point substantially coplanar with an end surface of the combustion cup.

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33. The method of claim 30 wherein the filter length is sized to reduce or increase a gas pressure resulting from activation of the gas generator.

34. A gas generator manufactured according to the method of claim 30.

BELT AND SIDE IMPACT INFLATOR

ABSTRACT OF THE DISCLOSURE

The present invention provides an airbelt inflator (10) designed primarily for supplying and directing gas from the combustion of gas generant materials into a vehicle airbelt. Inflator (10) includes a substantially cylindrical inflator body (12), having a first end (11) and a second end (13). A unique booster cup (22) is positioned within inflator body (12), and is preferably press fit with initiator body (15), suspending cup (22) within inflator body (12). Cup (22) facilitates consistent burn of the main propellant, imparting repeatable bag performance. A cylindrical mesh filter (38) is positioned in inflator body (12). A nozzle (36) is preferably positioned adjacent a disc (30). A variety of different nozzles giving inflator (10) varying gas output characteristics can be utilized with inflator (10), for example thrusting inflators or thrust-neutral inflators, depending on the operating requirements of the airbelt system. Booster cup (22) is sized such that it extends into inflator body (12), and abuts filter (38), thereby serving as a stand off or locator for filter (38), and providing a relatively snug packing arrangement for propellant tablets (28).

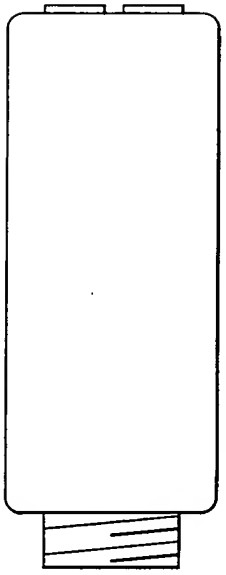
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Fig. 1.

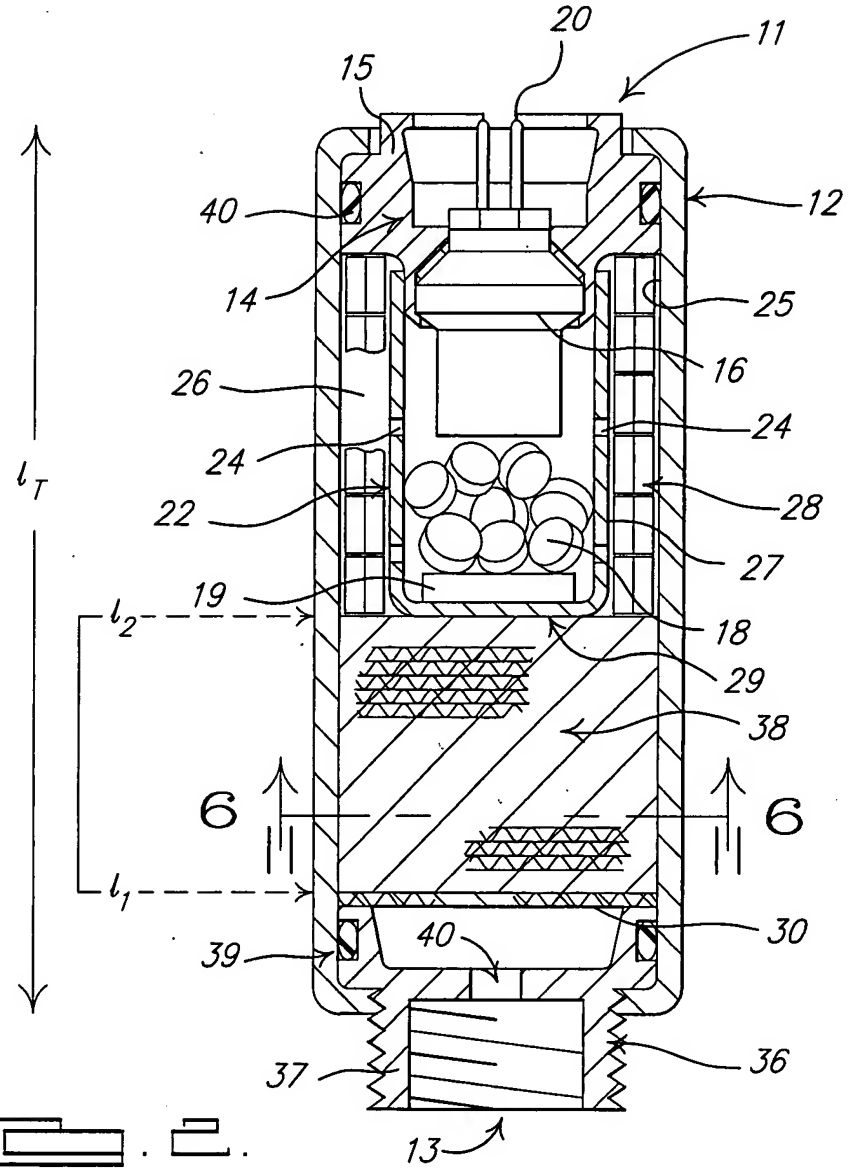
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Fig. 2.

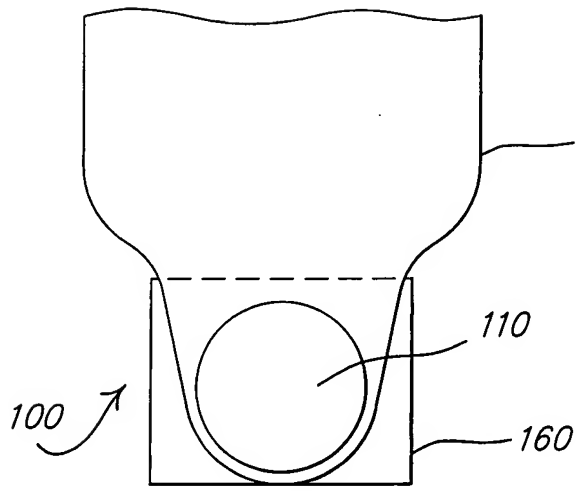

Fig. 3.

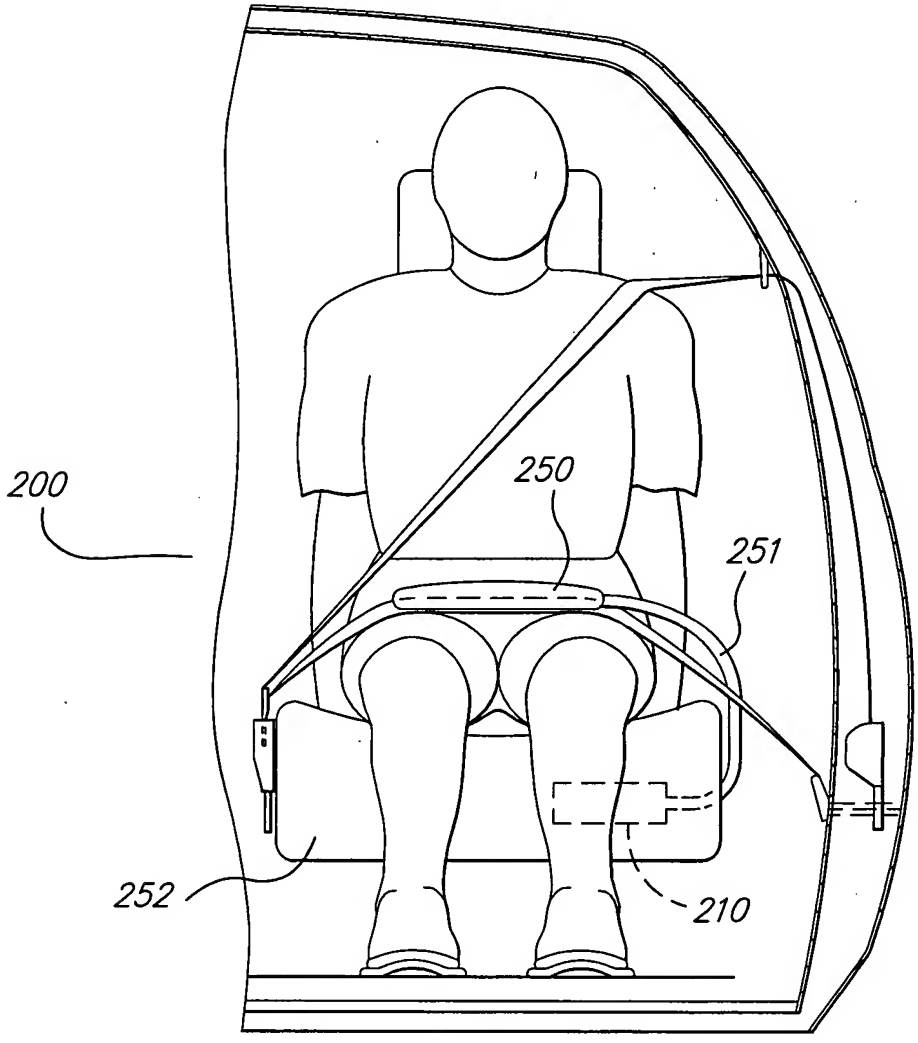

Fig. 4.

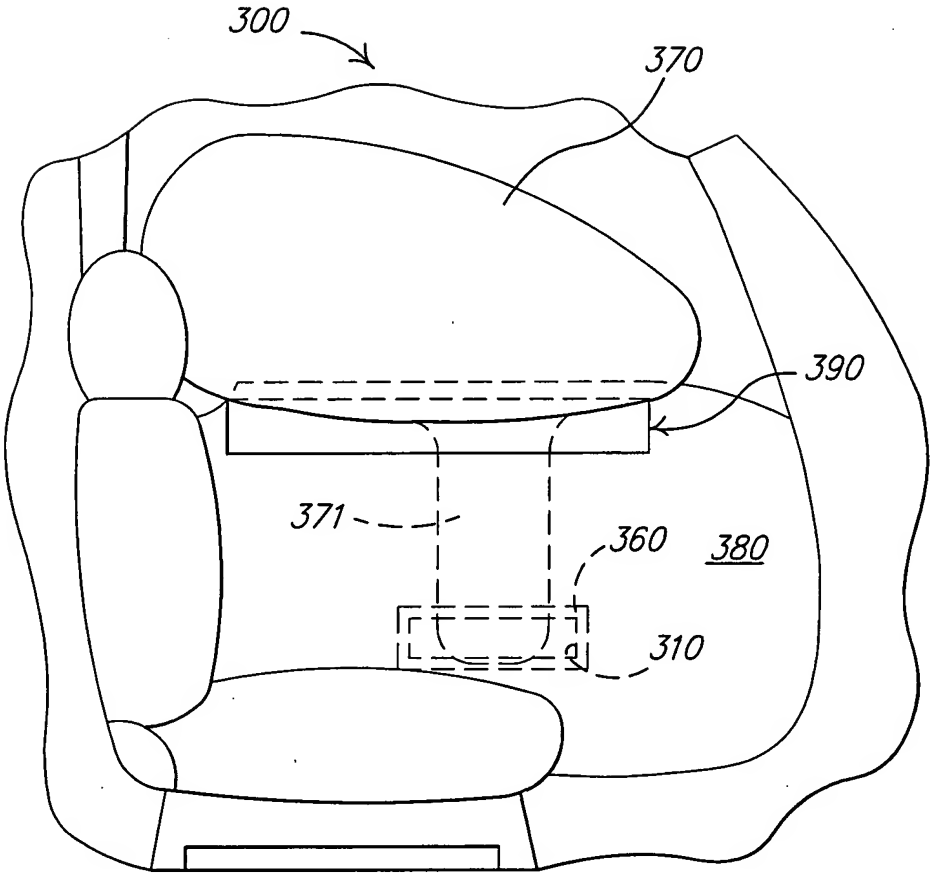

Fig. 5.

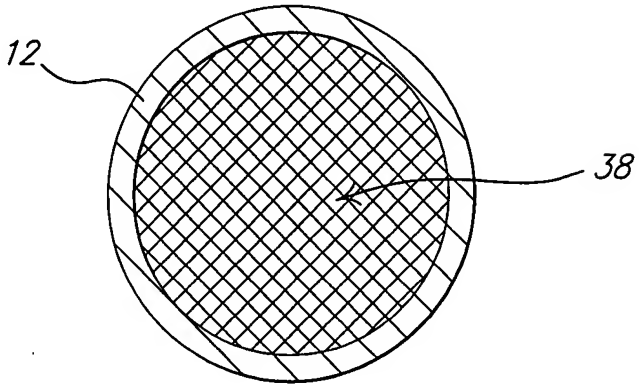

Fig. 6.

Appendix B

First Office Action (paper no. 20060421), mailed May 4, 2006

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/826,437	04/16/2004	Eduardo L. Quioc	5702-01051	1043

7590 05/04/2006

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PMB 403
510 Highland Avenue
Milford, MI 48381

EXAMINER	
ROSENBERG, LAURA B	

ART UNIT	PAPER NUMBER
3616	

DATE MAILED: 05/04/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

1 5-8 NFT 8-4-06
2 5/8 NF-6-4
3 DKS 7-4

Office Action Summary	Application No.	Applicant(s)	
	10/826,437	QUIOC ET AL.	
	Examiner	Art Unit	
	Laura B. Rosenberg	3616	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-34* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-34* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *16 April 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *11/26/04*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Information Disclosure Statement

1. The listing of references in the specification is not a proper information disclosure statement. 37 CFR 1.98(b) requires a list of all patents, publications, or other information submitted for consideration by the Office, and MPEP § 609.04(a) states, "the list may not be incorporated into the specification but must be submitted in a separate paper." Therefore, unless the references have been cited by the examiner on form PTO-892, they have not been considered.

Specification

2. The disclosure is objected to because of the following informalities: "internally projecting ledge" and "filter" have both been assigned reference number "38" (page 5).

Appropriate correction is required.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 14-22 and 27-29 rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In regards to claim 14, line 11, and claim 27, line 8, it is unclear what is securing the propellant charge in the space. If the filter is accomplishing this, then the examiner

recommends rephrasing to read, "a filter in said inflator body, said filter securing said propellant charge in said space".

Claim 18 recites the limitation "said booster cup" in line 2; claim 27 recites the limitation "said inflator body" in line 4. There is insufficient antecedent basis for these limitations in the claims.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims 1-21 and 27-34 are rejected under 35 U.S.C. 102(b) as being anticipated by Kirchoff et al. (3,972,545). Kirchoff et al. disclose an inflator (including #5) able to be used with an inflatable restraint system (for example, an airbag), comprising:

- Inflator body (including #6) having a first end (for example, left end in figure 1) and a second end (for example, right end in figure 1)
- Elongate, substantially cylindrical booster/combustion cup (including #34) extending in the body, oriented substantially coaxially with the inflator body, and having an outer peripheral wall (for example, outer cylindrical wall) and an end surface (for example, right end in figure 1) extending radially inwardly from the wall
- Plurality of apertures formed in the outer peripheral wall (apertures formed when peripheral wall of tube is ruptured by squib and pyrotechnic material)

- First propellant charge (including #21) positioned in the booster/combustion cup
- Second propellant charge (including #18) positioned in the inflator body
- Initiator assembly (including squibs #19, 20) able to activate the first propellant charge, a combustion thereof initiating a combustion of the second propellant charge and ejection of an inflation gas from the inflator body (via discharge orifice #13)
- Inflator body comprises an inner peripheral wall separated from the outer peripheral wall by a substantially annular space, the second propellant charge being positioned in the space, substantially adjacent the outer peripheral wall (best seen in figure 1)
- Second propellant charge comprise a plurality of propellant tablets (including #18) and substantially fills the space between the outer peripheral wall and the inner peripheral wall of the inflator body (best seen in figure 1)
- Filter (including #22, 24, 28, 29, 30, 32) constraining the second propellant charge in the space (best seen in figure 1)
- Nozzle (including #12) positioned at the second end of the body and defining a nozzle outlet (including #13) able to supply an inflation gas to the inflatable restraint system
- Filter positioned adjacent the end surface (in particular, filter component #22)
- Body has a total length and an area defined by a cross-section, and the filter has a given length about one-half (though not necessarily drawn to scale, filter appears to be about one-half of the total length of the body, as seen in figure 1), the filter occupying a volume determined by multiplying the cross-section of the body by the length of the filter

- Substantially annular space separating inner peripheral wall and outer peripheral wall extends longitudinally in the inflator body from a point proximate the first end up to a point substantially coplanar with the end surface of the booster/combustion cup (best seen in figure 1)
- Nozzle constrains the filter against axial displacement (for example, via contact of right end of filter with left end of nozzle including perforated annulus #33, as seen in figure 1)
- Tablets (including #18) positioned in a geometrically ordered fashion in the annular space (for example, as seen in figure 1)
- Tablets (including #18) stacked adjacently in the annular space and having cylindrical axes oriented substantially perpendicular the inner peripheral wall (for example, as seen in figure 1)
- Booster/combustion cup attached to initiator body (including plug at left end of squib #19 that is attached to end cap #7) and suspended therefrom, being supported in the inflator body solely by the attachment to the initiator body (best seen in figure 1)
- Filter is substantially cylindrical and includes a substantially cylindrical periphery positioned adjacent the inner peripheral wall (best seen in figure 1) and a substantially planar end (for example, left end of filter portion #22) positioned flush with the end surface (right end of booster/combustion cup)
- Nozzle is threadingly engaged with the inflator body (at screw threads #11)
- Filter length is sized to change the gas pressure resulting form activation of the gas generator (for example, column 4, lines 9-16)

7. Claims 1-6 and 23-29 are rejected under 35 U.S.C. 102(b) as being anticipated by Adams et al. (4,437,681). Adams et al. disclose an inflator (best seen in figure 1) able to be used with an inflatable restraint system (can be seen in figure 3), comprising:

- Inflator body (including #10)
- Elongate, substantially cylindrical booster cup (including #33) extending in the body, oriented substantially coaxially with the inflator body, and having an outer peripheral wall (for example, outer cylindrical wall) and an end surface (for example, left end in figure 1) extending radially inwardly from the wall
- Plurality of apertures (including #36) formed in the outer peripheral wall
- First propellant charge (including #35) positioned in the booster cup
- Second propellant charge (including #38) positioned in the inflator body
- Initiator assembly (including squib #34) able to activate the first propellant charge, a combustion thereof initiating a combustion of the second propellant charge and ejection of an inflation gas from the inflator body (via outlet ports #13, 14)
- Inflator body comprises an inner peripheral wall separated from the outer peripheral wall by a substantially annular space, the second propellant charge being positioned in the space, substantially adjacent the outer peripheral wall (best seen in figures 1, 2)
- Second propellant charge comprise a plurality of propellant tablets (including #38) and substantially fills the space between the outer peripheral wall and the inner peripheral wall of the inflator body (best seen in figures 1, 2)

- Filter (including #24-27, 29) constraining the second propellant charge in the space (best seen in figure 1)
- Inflatable airbelt (for example, including cushion #39 of safety harness #40)

8. Claims 1-12, 14-16, 19-21, and 27-29 are rejected under 35 U.S.C. 102(b) as being anticipated by Ruckdeschel et al. (6,196,583). Ruckdeschel et al. disclose an inflator (best seen in figure 1) able to be used with an inflatable restraint system (for example, an air-bag system), comprising:

- Inflator body (including #1) having a first end (for example, bottom end in figure 1) and a second end (for example, top end in figure 1)
- Elongate, substantially cylindrical booster/combustion cup (including #5) extending in the body, oriented substantially coaxially with the inflator body, and having an outer peripheral wall (for example, outer cylindrical wall) and an end surface (for example, top end in figure 1) extending radially inwardly from the wall
- Plurality of apertures (including #4) formed in the outer peripheral wall
- First propellant charge (including #3) positioned in the booster/combustion cup
- Second propellant charge (including #6) positioned in the inflator body
- Initiator assembly (including igniter #2) able to activate the first propellant charge, a combustion thereof initiating a combustion of the second propellant charge and ejection of an inflation gas from the inflator body (via bore holes #9)

- Inflator body comprises an inner peripheral wall separated from the outer peripheral wall by a substantially annular space, the second propellant charge being positioned in the space, substantially adjacent the outer peripheral wall (best seen in figure 1)
- Second propellant charge comprise a plurality of propellant tablets (including #6) and substantially fills the space between the outer peripheral wall and the inner peripheral wall of the inflator body (best seen in figure 1)
- Filter (including #7) constraining the second propellant charge in the space (best seen in figure 1)
- Nozzle (including #10) positioned at the second end of the body and defining a nozzle outlet (for example, upper opening of nozzle) able to supply an inflation gas to the inflatable restraint system
- Filter positioned adjacent (in close proximity to) the end surface
- Body has a total length and an area defined by a cross-section, and the filter has a given length about one-fourth (though not necessarily drawn to scale, filter appears to be about one-fourth of the total length of the body, as seen in figure 1), the filter occupying a volume determined by multiplying the cross-section of the body by the length of the filter
- Substantially annular space separating inner peripheral wall and outer peripheral wall extends longitudinally in the inflator body from a point proximate the first end up to a point substantially coplanar with the end surface of the booster/combustion cup (best seen in figure 1)

- Nozzle constrains the filter against axial displacement (for example, via contact of upper end of filter with lower end of nozzle including plate #8, as seen in figure 1)
- Tablets (including #6) positioned in a geometrically ordered fashion in the annular space (for example, as seen in figure 1)
- Tablets (including #6) stacked adjacently in the annular space and having cylindrical axes oriented substantially perpendicular the inner peripheral wall (for example, as seen in figure 1)
- Booster/combustion cup attached to initiator body (including #2 and surrounding housing) and suspended therefrom, being supported in the inflator body solely by the attachment to the initiator body (best seen in figure 1)

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. Claims 14 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takeuchi (6,145,873) in view of Ruckdeschel et al. (6,196,583). Takeuchi discloses an inflatable restraint system (for example, an air belt system) able to be used with a motor vehicle, comprising:

- Inflatable restraint device (including air belt #56)

- Inflator (including #26) able to provide an inflation gas to the inflatable restraint device and comprising an elongate substantially cylindrical inflator body (can be seen in figure 3) having a first end (for example, bottom end as seen in figure 3) and a second end (for example, top end as seen in figure 3) and an inner peripheral wall (not shown, but would be interior wall of inflator body)
- Inflatable restraint is an airbelt (including #56)

Takeuchi does not specifically disclose all of the interior features of the inflator, such as a combustion cup, apertures, propellant charge, filter, or nozzle member.

Ruckdeschel et al. teach an inflatable restraint system, as set forth above, including an elongate combustion cup, plurality of apertures, propellant charge, filter, and nozzle member. It would have been obvious to one skilled in the art at the time that the invention was made to modify the inflator of Takeuchi such that it comprised combustion cup, apertures, propellant charge, filter, and nozzle as claimed in view of the teachings of Ruckdeschel et al. so as to allow for the possibility of thinner wall thicknesses, the employment of other materials, lightweight structures and inflator designs which are more cost-effective and have a smaller geometry, so as to filter out slags and salt particles materializing from combustion, which leads to reduced particle emissions, and so as to produce cooler inflator exit gases, as well as other benefits (Ruckdeschel et al.: columns 3, 4).

Conclusion

11. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Davis et al., Winterhalder et al., Cook et al., Nakashima et al., Longhurst et al., and Werner each disclose an inflator comprising an inflator body, booster cup with a propellant and apertures, second propellant in a space between booster cup and inflator body interior wall, and initiator assembly.

O'Loughlin et al., Suyama, Lewis, Schneider et al., Busgen et al., Braun et al., and Quioc et al. each disclose an inflator that can be used in an airbelt.

Bernau et al., Van Wynsberghe et al., Cabrera, Smith et al., Yamazaki et al., and Yoshida et al. each disclose an inflator with several features similar to applicant's claimed invention.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Laura B. Rosenberg whose telephone number is (571) 272-6674. The examiner can normally be reached on Monday-Friday 7:00am-3:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul Dickson can be reached on (571) 272-6669. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Laura B. Rosenberg

Laura B Rosenberg
Patent Examiner
Art Unit 3616

LBR

4/26/06

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 1

Complete if Known	
Application Number	10/826,437
Filing Date	April 16, 2004
First Named Inventor	Eduardo L. Quioc
Art Unit	3616
Examiner Name	
Attorney Docket Number	5702-01051

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Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
LBR		US- 2995088	08-08-1961	R.K. Asplund	
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Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T[6]

Examiner Signature	Diane B. Rosenberg	Date Considered	4-3-06

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

Notice of References Cited	Application/Control No. 10/826,437	Applicant(s)/Patent Under Reexamination QUIOC ET AL.	
	Examiner Laura B. Rosenberg	Art Unit 3616	Page 1 of 2

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NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
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	V	
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Notice of References Cited	Application/Control No. 10/826,437	Applicant(s)/Patent Under Reexamination QUIOC ET AL.	
	Examiner Laura B. Rosenberg	Art Unit 3616	Page 2 of 2

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Beschreibung

Aus der DE-PS 23 30 194 der Anmelderin sind Gasgeneratoren für den Insassenschutz von Kraftfahrzeugen bekannt und auch ein Beispiel zum Einbau in einer Struktur (Fig. 4) gegeben. Die dort gezeigten Ausführungsbeispiele haben entweder eine zentrale Anzündeinrichtung oder eine Anzündeinrichtung auf beiden Seiten (Stirnseiten) eines im wesentlichen zylinder- bzw. rohrförmigen Gasgenerators.

Es sind dort auch Mittel vorgesehen, die das Gas auf seinem Strömungsweg bis zum Gaskissen abkühlen sollen und gleichzeitig als Schalldämpfer wirken. Diese Mittel bilden insbesondere labyrinthartige Strömungswege aus.

In vielen Fällen ist es heute nötig, ein großes Gasvolumen jeweils in sehr kurzer Zeit (z. B. mehr als 100 Liter in dem Bereich von 30 bis 60 ms) zu erzeugen. Hierzu ist es nötig, eine weitaus größere Treibstoffmenge üblicher Festtreibstoffe für Gasgeneratoren einzusetzen. Es ist deshalb auch schon vorgeschlagen worden (siehe die US-PS 39 72 545) zwei Treibsätze hintereinandergeschaltet mit jeweils einer Anzündeinheit in einem rohrförmigen Gehäuse unterzubringen, welche nacheinander gezündet werden. Bei der in dieser Schrift gezeigten Anordnung ist jedoch das zur Verfügung stehende Volumen für den Treibsatz noch immer relativ gering, weil außer Filtermitteln noch Platz für ein pH-Wert neutralisierendes Material benötigt wird. Außerdem sind die verschiedenen Filter und andere Kammern alle einseitig in dem rohrförmigen Gehäuse axial in bezug auf die Strömungsrichtung des Gases hintereinander angeordnet.

Aufgabe vorliegender Erfindung ist es, bei einem gegebenen Einbauvolumen eines Gasgenerators, insbesondere eines Beifahrergasgenerators in Zylinder- bzw. Rohrform einen möglichst großen Raum zur Aufnahme eines Festtreibstoffes bereitzustellen, andererseits jedoch, ohne die Wirkungsweise des Gasgenerators zu beeinträchtigen, mit nur einer Anzündeinheit, mit wenigen Bauteilen und mit möglichst wenig teuerem Filtermaterial auszukommen.

Gelöst wird diese Aufgabe nach den Merkmalen des Anspruchs 1, insbesondere durch die Ausbildung des Gehäuses mit einem großen Verhältnis Länge zu Durchmesser und der günstigen Anordnung sowohl der Filter als auch der Öffnungen im Brennkammergehäuse und Filtergehäuse für den Durchlaß bzw. dem Strömungsweg des Gases zum Gaskissen hin.

Weitere Vorteile sind den Unteransprüchen sowie der Beschreibung von Ausführungsbeispielen zu entnehmen.

Der Beifahrer Gasgenerator ist röhrenförmig aufgebaut. Er besteht aus einem äußeren Gehäuse 2, welches auf der einen Seite von einer Platte 15 verschlossen wird und aus einem tiefgezogenen Blech, vorzugsweise Aluminium, besteht. Die Platte 15 dient als Träger für die Anzündeinheit 14 mit dem Anzünder 16 und der Anzündmasse 20.

Innerhalb des Gehäuses 2 liegt die Brennkammer 13 mit den Düsenbohrungen 12. Sie enthält den Treibstoff in Form von z. B. Tabletten 1 oder anderer Formgebung.

Nach Entzünden des Treibstoffes 1 durch die Anzündeinheit 14 tritt das heiße Gas aus den Düsenbohrungen 12 aus in das die Brennkammer umgebende Filtergewebe, dargestellt z. B. durch ein Drahtgestrick 10 und wird dann am Filterrohr 4, welches auf der einen Seite der Brennkammer geführt wird und auf der anderen Seite mittels einer Schraubverbindung 9 befestigt ist, abgelenkt. Durch versetzt angeordnete Düsenlöcher 11 im Filterrohr 4 wird das Gas mehrfach umgelenkt und tritt dann nach dem Filterrohr 4 aus in ein weiteres Filtergewebe 3 und trifft danach auf das umhüllende Gehäuse 2. Das Gas strömt nun in Längsrichtung des Gehäuses zum Stirnende hin und trifft nun auf den Gasumlenkring 5, welcher über federnde Stützarme das darunterliegende Filterpaket 8 in Position hält. Im Expansionsraum 21 wird das Gas gesammelt und anschließend vom Gasteiler 6 verwirbelt und abschließend dadurch gleichmäßig auf das Feinfiltergewebe 8 verteilt. Über das(die) Filterfenster 17 im unteren Teil des Generatorgehäuses 2 tritt das gereinigte und abgekühlte Gas in den Luftsack ein. Vorkehrungen zum Schutz des Treibstoffes gegen Feuchtigkeit bzw. Umwelteinflüsse sind durch eine Alu-Folie (selbstklebend) 19 über den Düsenbohrungen 12 dargestellt.

Mittels eines im Gehäuse integrierten oder auch nachträglich angebrachten Stehbolzen 7 kann der Gasgenerator in einem geeigneten Modulgehäuse befestigt werden.

Die Verbindung von Gehäuse 2, Brennkammergehäuse 13 und Anzündeinheit 14 mit der Platte 15 kann, wie gezeigt, über Elektronenstrahlschweißen (EB 18) erfolgen. Jedoch sind auch einfache Verfahren denkbar, wenn man z. B. durch Vergrößerung der Schraube 9 die Gewindeöffnung als Einfüllöffnung für die Befüllung mit Treibstoff (dieses nach dem Schweißen) benutzt.

Als Vorteile des erfindungsgemäßen Konzeptes gelten:

- Mehrfache Gasumlenkung, dadurch extrem gutes Partikelausscheiden ohne teures Filtermaterial. Die Notwendigkeit des Maschengestrickes ist bei etwas akzeptableren Anforderungen hinsichtlich Partikelmenge fragwürdig, d. h. es wird durch die mehrfache Gasumlenkung deutlich weniger Filtermaterial notwendig.
- Durch die Brennkammerauslegung mit hohem L/D Verhältnis kann
  a) die Festigkeit der Wandung durch großen Düsenabstand sehr effizient gestaltet werden (Kerbwirkung sehr klein) und
  b) der Abbrand erfolgt axial, d. h. weder eine Verblockung durch zuviel Gasproduktion bei zu kleiner Düsenfläche noch ein zu schnelles Abbrennen der Treibstofftabletten ist möglich.

Ein zusätzlicher großer Vorteil ist: Durch geschickte Auslegung der Brennkammer kann die Gasproduktion am Anfang beeinflußt werden, z. B. dadurch, daß man im Bereich der Anzündung weniger/mehr Düsenbohrungen anordnet als im weiteren Verlauf. Mit anderen Worten, die Gasproduktion ist im gewissen Bereich durch die Verteilung der Düsenbohrungen über der Brennkammerlängsachse zu steuern.

- Durch o. g. hohes L/D kann bei seitlicher Anzündung mit wenig Anzündmasse gearbeitet werden, da die einmal entzündeten ersten Tabletten als "booster" für das weitere Anzünden der Restladung benutzt werden.
- Die Berstsicherheit des Gasgenerators wird durch das die Brennkammer umgebende Gehäuseteil 2 deutlich verbessert und resultiert in einer möglichen Gewichtseinsparung durch dünnere

Brennraumwandung.

— Durch die Formgebung der wichtigsten Teile Brennkammer 13, Gehäuse 2 und Filterrohr 4 als homogenes, einteiliges Stück ergeben sich bezüglich Festigkeit nur wenige, gezielt kontrollierbare Schwachstellen, in Form der Anbindung an Teil 15 mittels z. B. EB-Schweißen oder auch Reibschweißen vorstellbar.

Abwandlungen der vorbeschriebenen Ausführungsbeispiele sind wie folgt möglich:

1. Variante

Statt des büchsenförmigen Gehäuses 2 mit Deckel 18 kann ein rohrförmiges Gehäuse 2 mit zwei gleichen stirnseitigen Deckeln 18 verwendet werden.

2. Variante

Die Schraube 7 ist als Hohlschraube gleichen Durchmessers wie das Gehäuse der Anzündeinheit 20 ausgeführt. Somit liegt dann ein vollständig symmetrisches und symmetrisch befestigbares (an einer Struktur eines Fahrzeuges) Gehäuse vor.

3. Variante

Statt der Feinfilter- und Gasteileranordnung wie in der rechten Hälfte der Zeichnung nach Fig. 1 dargestellt — wie es ja auch Gegenstand des DE-PS 38 34 892 C2 ist — könnte der Gasteiler selbst Feinfilter 22 und 23 im Gasteiler als Vorstufe vor dem Feinfilter 8 aufweisen. Ebenso wie das Grobfilter 24 die Vorstufe vor den Grobfiltern 3 und 4 ist.

Eine weitere Variante könnte es sein, daß die Brennkammerwandstirnseite nicht wie dargestellt ausgebildet ist, sondern ebenfalls zu einer Scheibe solchen Durchmessers vergrößert ist, daß der Außendurchmesser einer solchen Scheibe direkt mit der Innenwand des Gehäuses 2 fest verbunden wird. Dann ist auch der Halter 5 für das Feinfilter 8 direkt hiermit verbunden und in der Scheibe sind im Bereich nahe der Außenwandung mehrfach Auslaßöffnungen für das Gas in Richtung Gaskissen vorzusehen. Die Schraube 9 kann dann entfallen, weil die Brennkammerwandung über ihre Länge hin gesehen dann ebenfalls symmetrisch ausgebildet ist, d.h. an ihrem dem Feinfilter zugekehrten Ende die gleichen Durchmesser aufweist wie am stirnseitigen Ende des Deckels 15.

Patentansprüche

1. Gasgenerator einer Aufprallschutzvorrichtung, insbesondere einem auflasbaren Schutzkissen für Kraftfahrzeuginsassen mit Filtereinrichtung zum Zurückhalten von Abbrandpartikeln und Kühlen des Gases, welches in das Schutzkissen überströmen soll, wobei rotationssymmetrische Gehäuseteile mit stirnseitig konzentrisch angeordneten Teilen zusammengefügt sind, **dadurch gekennzeichnet**, daß an einer Stirnseite des Gasgenerators eine Anzündeinheit angeordnet ist, welche strömungsmäßig mit einem Treibsatz verbunden ist, der in einer Brennkammer enthalten ist, wobei das beim Abbrand dieses Treibsatzes entstehende Gas in ein erstes Filter eintritt, das in axialer Richtung durchströmt wird, dann durch weitere Öffnungen wieder radial in eine zweite Filterstufe eintritt und anschließend axial durch die Form des Gehäuses bedingt in Richtung eines Feinfilters umgelenkt wird und wobei die Brennkammer so ausgelegt ist, daß sie ein hohes Länge zu Durchmesser Verhältnis aufweist und eine Anzahl radialer, auf der Längsachse verteilte Auslaßöffnungen aufweist.

2. Gasgenerator nach Anspruch 1, dadurch gekennzeichnet, daß die Auslaßöffnungen in der Brennkammerwandung so gewählt sind, daß sie eine relativ kleine Fläche für den Durchlaß des Gases aufweisen.

3. Gasgenerator nach Anspruch 2, dadurch gekennzeichnet, daß die auf die Brennkammerlängsachse bezogene Verteilung der Auslaßöffnungen in der Brennkammerwandung ungleich ist, d. h. vom Abstand zur Anzündeinheit abhängig ist.

4. Gasgenerator nach Anspruch 1, dadurch gekennzeichnet, daß das erste Filter in Strömungsrichtung als Grobfilter und das letzte Filter in Strömungsrichtung als Feinfilter ausgebildet ist.

5. Gasgenerator nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die Feinfilterhalterung einerseits mit der Brennkammerwandung verbunden ist und andererseits die Feinfilterhalterung in das Gehäuse einsetzbar ist.

6. Gasgenerator nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß sowohl das Gehäuse als auch das Filterrohr für das die Brennkammer umgebende Filter als homogenes einteiliges Stück hergestellt sind.

7. Gasgenerator nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die Halterung des Feinfilters mit der Halterung des Grobfilters fest verbunden ist.

8. Gasgenerator nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß das Feinfilter ebenso wie das Grobfilter mindestens zweistufig ausgeführt ist.

9. Gasgenerator nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die Durchlaßöffnungen in der Brennkammerwandung zu den Durchlaßöffnungen der Grobfilterwandung versetzt angeordnet sind, so daß sich ein labyrinthartiger Strömungsweg für das Gas ergibt.

10. Gasgenerator nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß zwischen Grobfilter und Feinfilter ein Expansionsraum zwischengeschaltet ist.

11. Gasgenerator nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß das Gehäuse im wesentlichen zylinderförmig ausgebildet ist und insbesondere in Form einer Büchse mit einseitigem Deckelverschluß ausgebildet ist.

12. Gasgenerator nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß das Gehäuse rohrförmig ausgebildet ist und auf beiden Stirnseiten mit Platten, Scheiben oder dgl. verschlossen ist, wobei auf der einen Stirnseite eine Anzündeinheit mit Außengewinde und auf der gegenüberliegenden Stirnseite, eine Schraube mit Außengewinde angeordnet ist, wobei diese beiden Außengewinde zur Halterung des Gasgenerators in einer Struktur dienen können.

Hierzu 1 Seite(n) Zeichnungen

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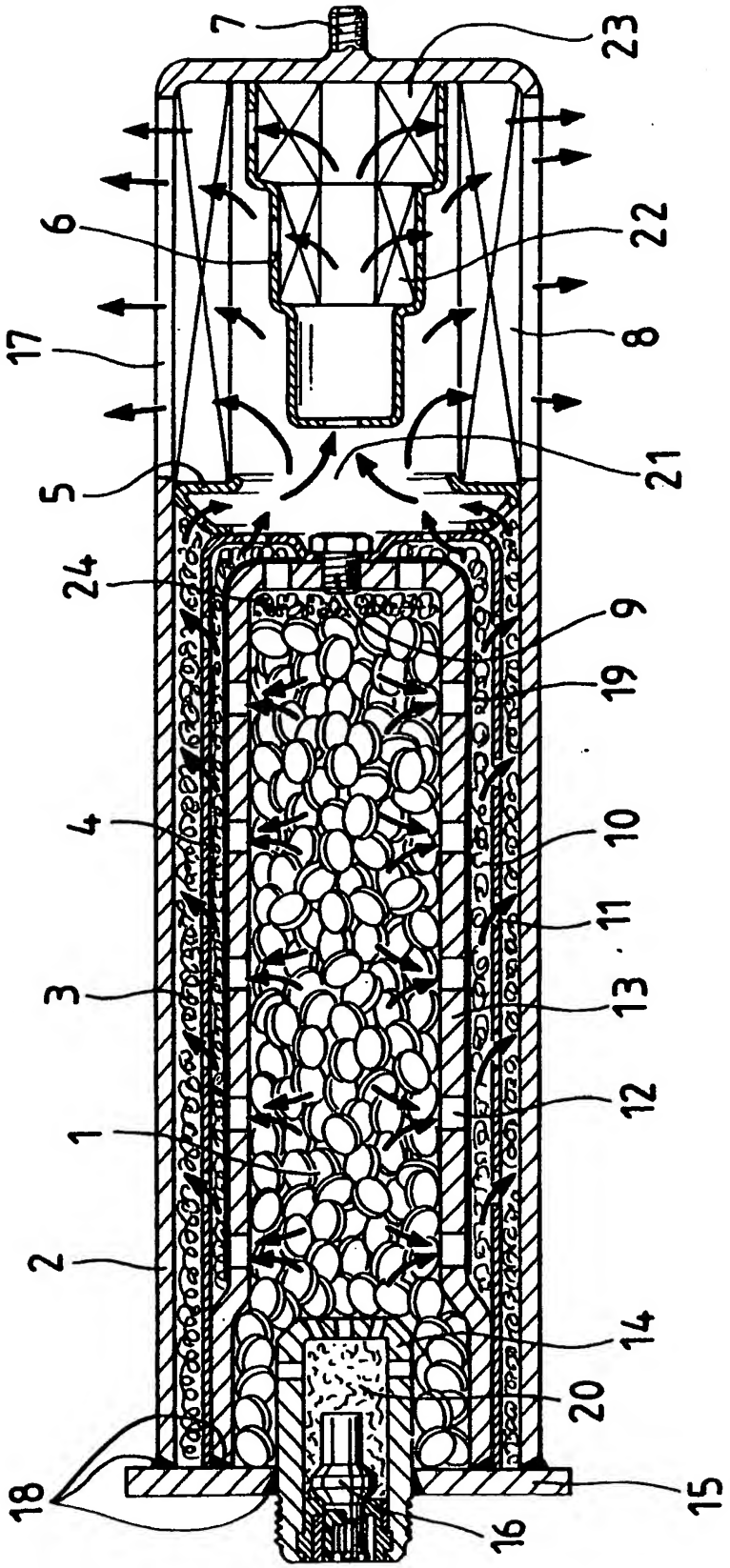
Offenlegungstag: 26. September 1991



(19) BUNDESREPUBLIK DEUTSCHLAND

DEUTSCHES PATENTAMT

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Prüfungsantrag gem. § 44 PatG ist gestellt

(54) Beifahrer Gasgenerator

(57) Gasgenerator einer Aufprallschutzvorrichtung, insbesondere einem aufblasbaren Schutzkissen für Kraftfahrzeuginsassen mit Filtereinrichtung zum Zurückhalten von Abbrandpartikeln und Kühlen des Gases, welches in das Schutzkissen überströmen soll, wobei rotationssymmetrische Gehäuseteile mit stirnseitig konzentrisch angeordneten Teilen zusammengefügt sind, wobei an einer Stirnseite des Gasgenerators eine Anzündeinheit angeordnet ist, welche strömungsmäßig mit einem Treibsatz verbunden ist, der in einer Brennkammer enthalten ist, wonach der Abbrand dieses Treibsatzes in ein erstes Filter eintritt, daß er in axialer Richtung durchströmt, dann durch weitere Öffnungen wieder radial in eine zweite Filterstufe eintritt und anschließend axial durch die Form des Gehäuses bedingt in Richtung eines Feinfilters umgelenkt wird.

DE 40 09 551 A1

Appendix C

Cited References:

1) Kirchoff et al., U.S. Patent No. 3,972,545
2) Schneider et al., U.S. Patent No. 6,279,945

United States Patent [19]

Kirchoff et al.

[11] **3,972,545**

[45] **Aug. 3, 1976**

[54] **MULTI-LEVEL COOL GAS GENERATOR**

[75] Inventors: **George F. Kirchoff**, Brigham City; **Fred E. Schneiter**, North Ogden, both of Utah

[73] Assignee: **Thiokol Corporation**, Newtown, Pa.

[22] Filed: **Mar. 10, 1975**

[21] Appl. No.: **557,204**

[52] **U.S. Cl.** ..... **280/735**; 102/37.7; 102/40; 180/103 A; 280/736; 280/741

[51] **Int. Cl.²** **B60R 21/08**

[58] **Field of Search** 102/40, 37.7; 180/103; 280/734, 735, 736, 741, 742

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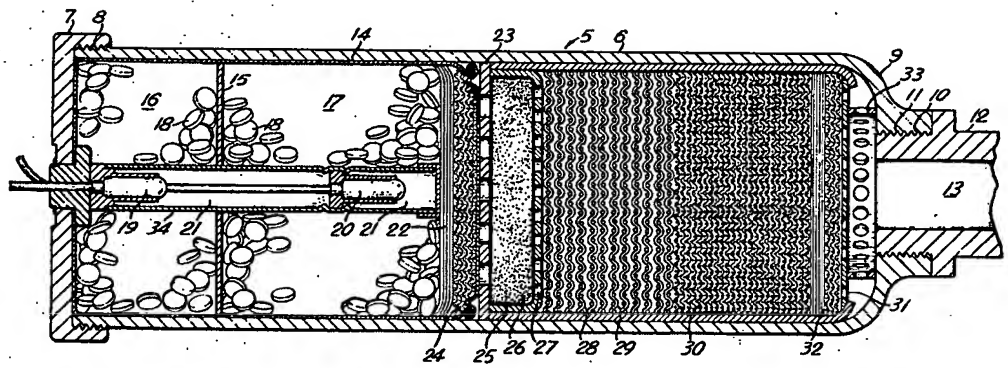
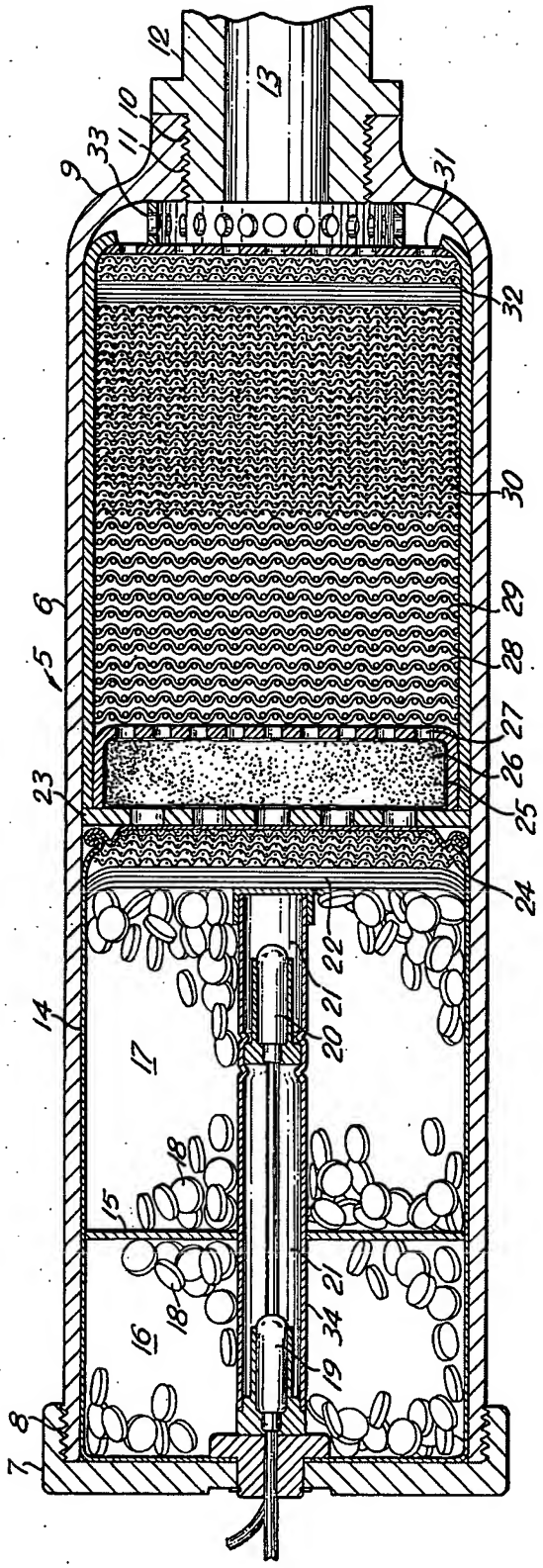
Primary Examiner—M. H. Wood, Jr.
Assistant Examiner—John P. Silverstrim
Attorney, Agent, or Firm—Stanley A. Marcus; Edward E. McCullough

[57] **ABSTRACT**

A gas generator for inflating safety cushions in automotive vehicles has a tubular housing, closed at both ends except for a discharge orifice in one end. A hermetically sealed container in the completely closed end of the housing is divided by a consumable partition into two chambers containing gas generant material. Each of the two chambers is also equipped with an ignition means for igniting the gas generant. The remainder of the tubular housing is filled with the following elements, arranged in tandem series from the sealed container to the orifice of the housing: a filtering means, a first perforated plate, pH neutralizing material, a second perforated plate, cooling means, and a third perforated plate. An impact sensor, which is not a part of the present invention, determines whether one or both of the ignition means are fired on impact, depending upon the force of a collision; and, hence, the rate at which an inflatable structure is filled with gas.

7 Claims, 1 Drawing Figure

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MULTI-LEVEL COOL GAS GENERATOR

CROSS-REFERENCES TO RELATED APPLICATIONS

This invention is related to U.S. Pat. application Ser. No. 417,349 "Gas Generator" by F. Schneiter, et al., filed Nov. 19, 1973.

BACKGROUND OF THE INVENTION

This invention relates to gas generators suitable for filling inflatable structures in the presence of humans. It has specific application to passive restraint cushions designed to provide impact protection to occupants of automotive vehicles.

The various degrees of violence experienced in automobile collisions make it impractical for a safety cushion to respond to all such situations with a fixed inflation level. An example of the extremes encountered would be the case of a large man in a high "g" impact and that of a child standing adjacent to the bag in a low level crash. A safety cushion forceful and fast enough to provide the support necessary to protect the large man in the high "g" impact deploys with such velocity that it would constitute serious risk of injury caused by rebound or rearward acceleration to the standing child in the low speed impact.

Attempts to solve this problem have been made in some current passive restraint systems by using a two level, pyrotechnic augmented, compressed gas bottle and a two level sensor. The sensor responds to the severity of impact by sending appropriate signals to fire one or both pyrotechnic charges. The burning pyrotechnics add heat to the stored gas and reduce the requirement for the quantity of gas that must be stored. The quantity of pyrotechnics being burned simultaneously determines the gas temperature and volume and resultant bag inflation level. An explosive charge ruptures a diaphragm at the orifice of the bottle.

This system, however, has been found to be unsatisfactory for a number of reasons: (1) The presence of an explosive charge at the orifice of the gas bottle and pyrotechnic charges inside the bottle of high-pressure gas makes this system somewhat hazardous to handle, ship, and store; (2) The system tends to be somewhat complex and bulky; and (3) The volume of gas and speed of its delivery to an inflatable structure is somewhat influenced by the initial temperature of the gas bottle — if it is initially very cold, the rate of inflation tends to be slowed.

A second two-stage system is shown and described in U.S. Pat. No. 3,663,035 to T. W. Norton, titled "Self-Contained Passenger Restraining System". (FIGS. 7 and 8). In this system, the main gas generating material is black powder; and, to avoid inflating the cushion with explosive force, the gas generant material is divided into two stages — one of which is delayed slightly by a time-delay fuse. This system is not intended to be responsive to variations in violence of impact on collision of the vehicle with another object; it is simply a means of using materials that are almost explosive to inflate a safety cushion.

SUMMARY OF THE INVENTION

The present invention has been developed to satisfy the need for a practical, reliable, gas-generating system for inflating safety cushions in automotive vehicles,

that will automatically respond to a signal and adjust the rate of inflation so that it is commensurate with the severity of impact. It is essentially a gas generator having a tubular housing, closed at both ends except for a discharge orifice in one end thereof. A hermetically sealed container in the completely closed end of the housing is divided into two parts by a consumable partition and each chamber contains gas generant material and an ignition means therefor. The remainder of the housing is filled, sequentially from the container to the orifice, with a filtering means, a first perforated plate, pH neutralizing material, a second perforated plate, a cooling means, spacing means, and a third perforated plate.

A sensing means, not a part of the present invention, delivers an electrical signal to the ignition means, which is preferably two electric squibs. If the shock is severe, they will be fired simultaneously by a high-level signal, i.e., a signal above some designated threshold of voltage and/or current, to fill an inflatable structure with the utmost rapidity to insure safety of the vehicle's occupants. If the shock is less severe, only the squib nearest the discharge orifice will be fired by a low-level signal from the sensor. In the latter case, the second squib and gas generant are ignited by heat of combustion from the first, and combustion must proceed away from the orifice through the gas generant material to release gas more slowly.

The prior invention described in the related application cited above (Ser. No. 417,349) has components similar to those of the present invention (e.g., igniter, gas generant, filtering and cooling means, and housing). However, its components were annular and concentric about the igniter, and it lacked the dual igniters and gas generants separated by the consumable partition of the present invention, and it could not deliver gases to an inflatable structure with different levels of force. Hence, the present invention is considered to be an improvement thereover.

BRIEF DESCRIPTION OF THE DRAWING

In the drawings:

The FIGURE is a longitudinal section of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The gas generator **5** of the present invention has a tubular housing **6**, closed at one end by an end cap **7** fastened by screw threads **8**. The opposite end has an integral end cap **9** having an opening **10** equipped with screw threads **11** to receive an adapter **12** that is a part of an inflatable structure not shown. The adapter **12** contains the discharge orifice **13**. A hermetically sealed container **14** is located adjacent the end cap **7** and contains a consumable partition **15** that divides it into two chambers **16** and **17**. The partition **15** is preferably made of polystyrene, but could be made of many other consumable materials. These two chambers are filled with identical gas generant material **18** that may be any of a number of compositions having the required properties relating to toxicity, heat of combustion, and rate of combustion. However, in this preferred embodiment, the composition comprises a mixture by weight of 55% sodium azide (NaN_3), and 45% anhydrous chromic chloride ($CrCl_3$) in the form of pellets. Each chamber **16** and **17** is further equipped with an electric squib **19** and **20**, respectively, surrounded by a pyro-

technic material 21. This material 21 may also be any one of a number of compositions; but, in our preferred embodiment, comprises a granular mixture of 25% by weight of boron and 75% of potassium nitrate.

The container 14 is preferably made of aluminum, about 5 mils thick; and is manufactured and sealed by the same process used for forming and sealing beverage cans.

A plurality of layers of filtering screens 22, comprising relatively fine wire screen (about 30 to 60 mesh) is adjacent the end of the container 14 and is retained in place by a first perforated plate 23 having the same diameter as the inside of the housing 6. A spacing means consisting of a plurality of layers of coarse screen 24 (about 8 to 16 mesh) separates the filtering screens 22 from the perforated plate 23 to provide a free-flow volume of space for gases that may emerge from the container 14 when the gas generant material 18 is fired. A plastic-film bag 25, containing a pH neutralizing material 26 is retained in a position adjacent the first perforated plate 23 by a second perforated plate 27. A preferred pH neutralizing material 26 is powdered iron sulfate, $Fe_2(SO_4)_3$ or $FeSO_4$. A cooling means 28 is made in two sections, the first section 29 comprises a plurality of layers of coarse wire screen similar to the spacing means 24, and the second section 30 comprising a plurality of layers of fine wire screen similar to the filtering screens 22. The second section 30 of the cooling means 28 is spaced from a third perforated plate 31 by a plurality of layers of coarse wire screen 32 similar to the spacing means 24. The third perforated plate 31 is in turn spaced from the main opening 10 of the housing 6 by a perforated annulus 33.

When the vehicle, in which the present invention is installed, collides with some other object, sensing devices, not a part of the present invention, deliver an electric signal. This signal or signals will then cause one or both electric squibs 19 and 20 to be fired. If the impact is severe, both squibs will be fired simultaneously for maximum effectiveness in delivering gases to the inflatable structure with maximum speed. However, if the impact is less severe, only the downstream squib 20 will be fired. In the latter case, combustion will proceed upstream through the partition 15 to ignite the squib 19 and the gas generant 18 in the upstream chamber 16. This provides a slower rate of inflation to provide a softer cushioning effect, but with the same quantity of gas.

It will be noted that the pyrotechnic material 21 that is contiguous with the upstream squib 19 extends well into the downstream gas generant chamber 17 via the tube 34 that holds both squibs 19 and 20 and the associated pyrotechnic materials 21. This tube 34 is made of very thin (about 5 mils) aluminum. Hence, in the event that a collision is of the low level type, wherein only the downstream squib 20 is ignited by an electric signal, the heat from the burning gas generant 18 in the downstream chamber 17 will be rapidly transmitted through the wall of the tube 34 to ignite the pyrotechnic material 21 that is associated with the upstream squib 19. The squib 19 and its pyrotechnic material 21 will then rupture the wall of the tube 34 to ignite the gas generant material 18 in the upstream chamber 16. This causes a somewhat slower delivery of gases to an inflatable structure than in the case of a high-level impact wherein both squibs are fired simultaneously.

The gases thus produced then pass through the fine filtering screens 22, into a plenum chamber created by the plurality of layers of coarse screens 24, that act as spacers to space the filter 22 away from the end of the container 14. When sufficient pressure is built up, the gases rupture the container 14 and pass through the perforations of the plate 23. They then enter the pH neutralizing material 26, where the somewhat alkaline gases are neutralized, through the second perforated plate 27, the cooling screens 28, through the third perforated plate 31 and perforated annulus 33 into the discharge orifice 13.

An invention has been described that adyances the art of safety devices for automotive vehicles. Although the preferred embodiment has been described specifically with regard to detail, it should be noted that many such details may be altered without departing from the scope of the invention, as it is defined in the following claims.

The invention claimed is:

1. In a gas generator for delivering gas to an inflatable structure in response to a sensor, said generator including a housing having an outlet orifice in communication with said inflatable structure, a gas generant material in said housing, and filtering and cooling means between said gas generant material and said orifice, the improvement comprising: a consumable partition dividing said gas generant material into first and second portions; a first electric-initiated igniter adjacent said first portion for igniting it in response to any signal from said sensor; a second electric-initiated igniter adjacent said second portion for igniting it in response to only a high-level signal from said sensor, said second igniter extending through said partition from said second portion into said first portion, whereby said second igniter may be ignited either simultaneously with said first igniter in response to said high-level signal, or sequentially, with respect to said first igniter, by the heat of combustion from said first portion.

2. The gas generator of claim 1 wherein each igniter comprises an electric squib and pyrotechnic material contiguous therewith.

3. The gas generator of claim 2 further including a thin-walled, easily rupturable tube, wherein the two igniters are contained, in tandem arrangement.

4. The gas generator of claim 1 wherein the housing is tubular and the gas generant, filtering means, and cooling means are arranged in tandem therein.

5. The gas generator of claim 1 further including a pH neutralizing material between the fitering means and the cooling means.

6. The gas generator of claim 1 wherein the filtering means and the cooling means are made of layers of wire screen.

7. The gas generator of claim 1 wherein the gas generant material and the ignition means are contained in an hermetically sealed, easily rupturable container.

* * * * *

US006279945B1

(12) **United States Patent**
Schneider et al.

(10) **Patent No.: US 6,279,945 B1**
(45) **Date of Patent: Aug. 28, 2001**

(54) **GUIDE FITTING FOR INFLATABLE VEHICULAR SAFETY BELT**

(75) Inventors: **David W. Schneider**, Waterford; **Pontus Soderstrom**, Rochester, both of MI (US)

(73) Assignee: **Autoliv ASP, Inc.**, Ogden, UT (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/479,620**

(22) Filed: **Jan. 7, 2000**

(51) **Int. Cl.**[7] **B60R 21/18**
(52) **U.S. Cl.** **280/733**; 280/808; 297/483
(58) **Field of Search** ..... 280/808, 733, 280/728.1, 801.1, 805, 801.2; 297/483, 470, 482; 24/163 R

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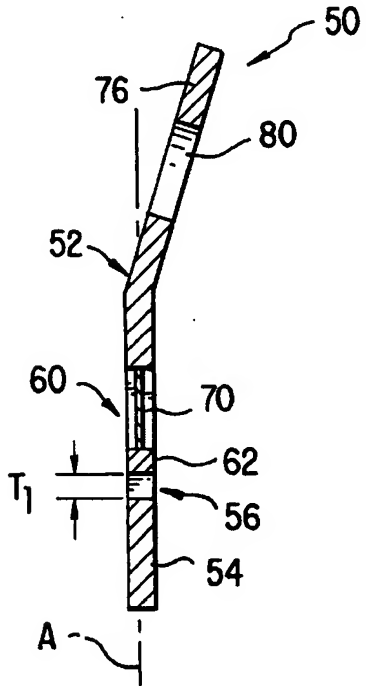
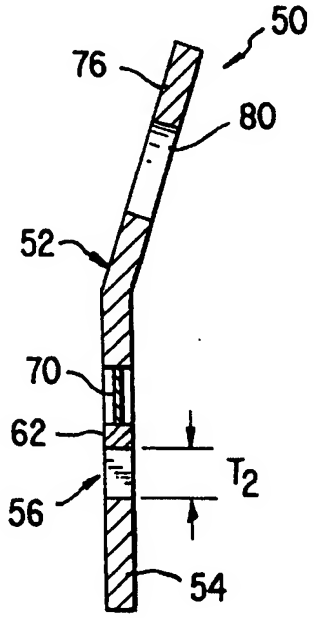
Primary Examiner—Brian L. Johnson
Assistant Examiner—Bryan Fischmann
(74) *Attorney, Agent, or Firm*—Sally J. Brown

(57) **ABSTRACT**

Vehicular restraint systems and associated fittings adapted for pivotal mounting onto a vehicle and for the guiding of an inflatable torso safety belt therethrough are provided. The fitting includes a clearance opening of selectively changeable thickness wherethrough the inflatable torso safety belt is passed to permit slidable movement thereof even when the inflatable safety belt is in an at least partially expanded or inflated state.

15 Claims, 4 Drawing Sheets





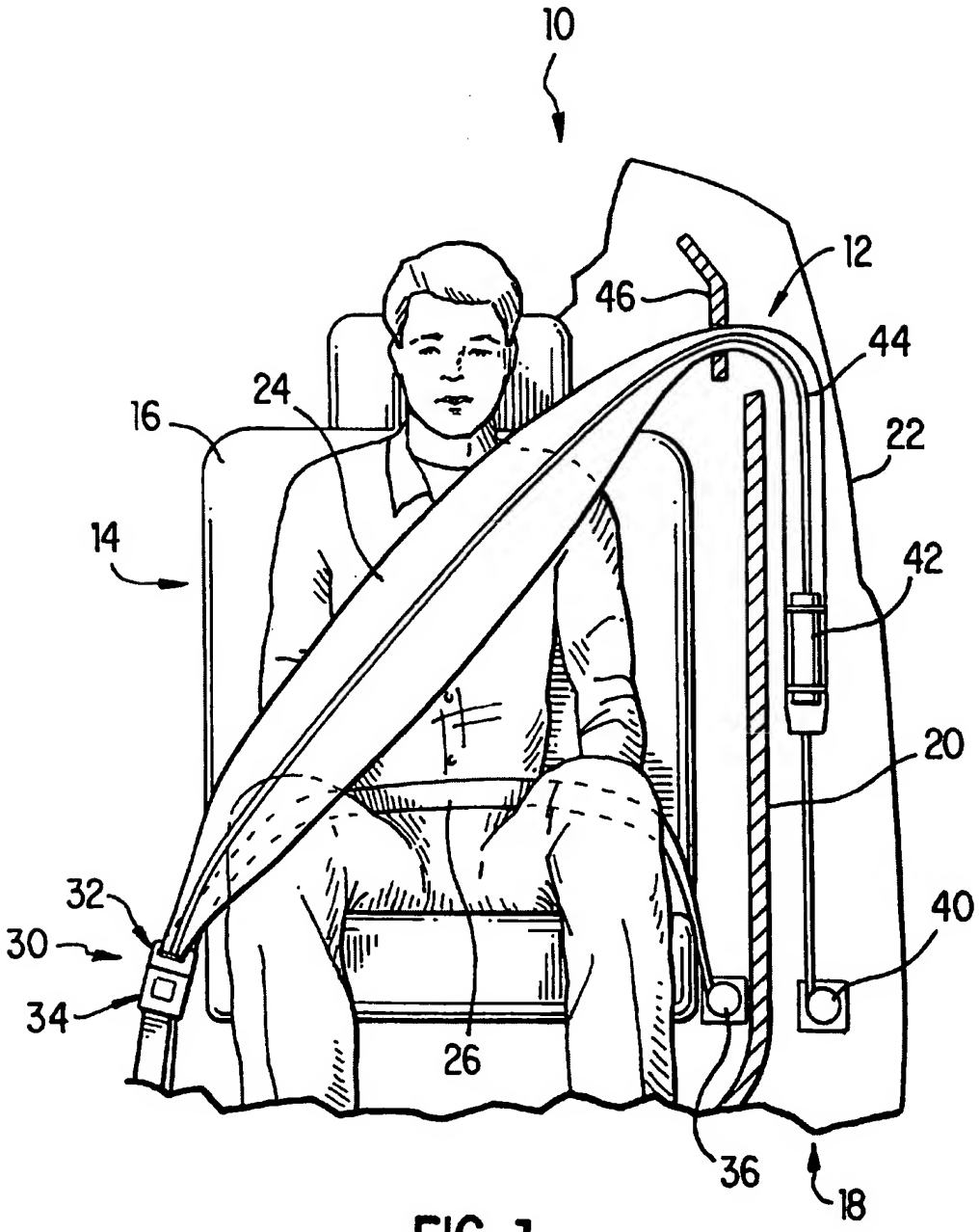


FIG. 1

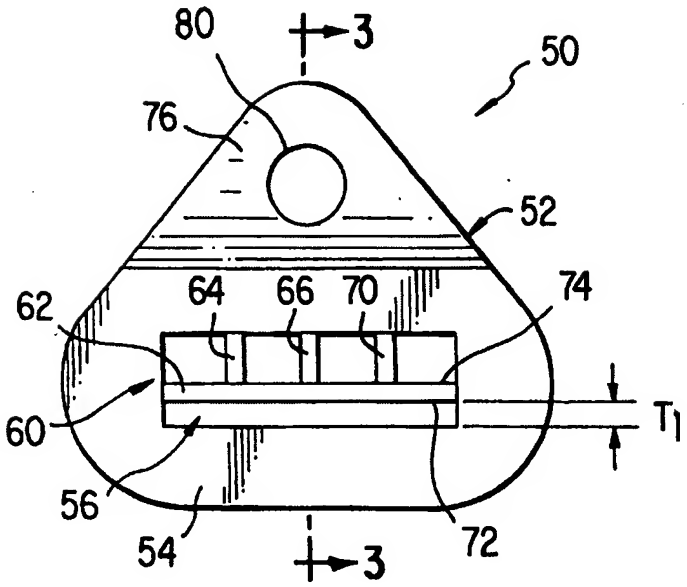


FIG. 2

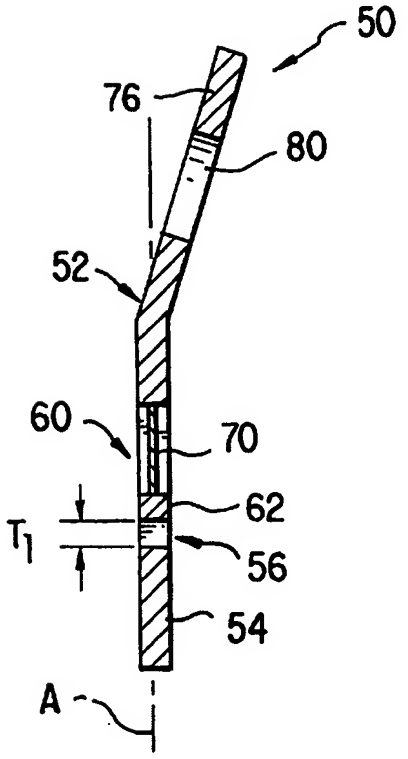


FIG. 3

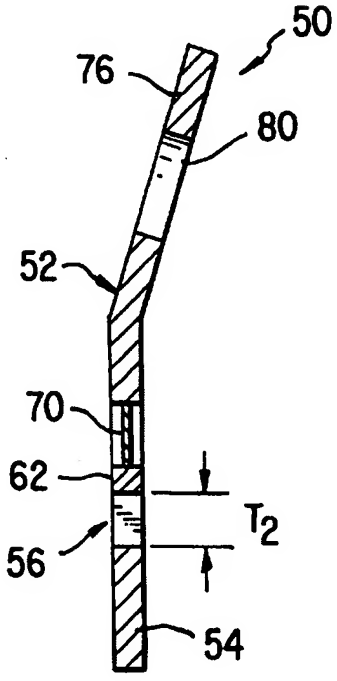


FIG. 4

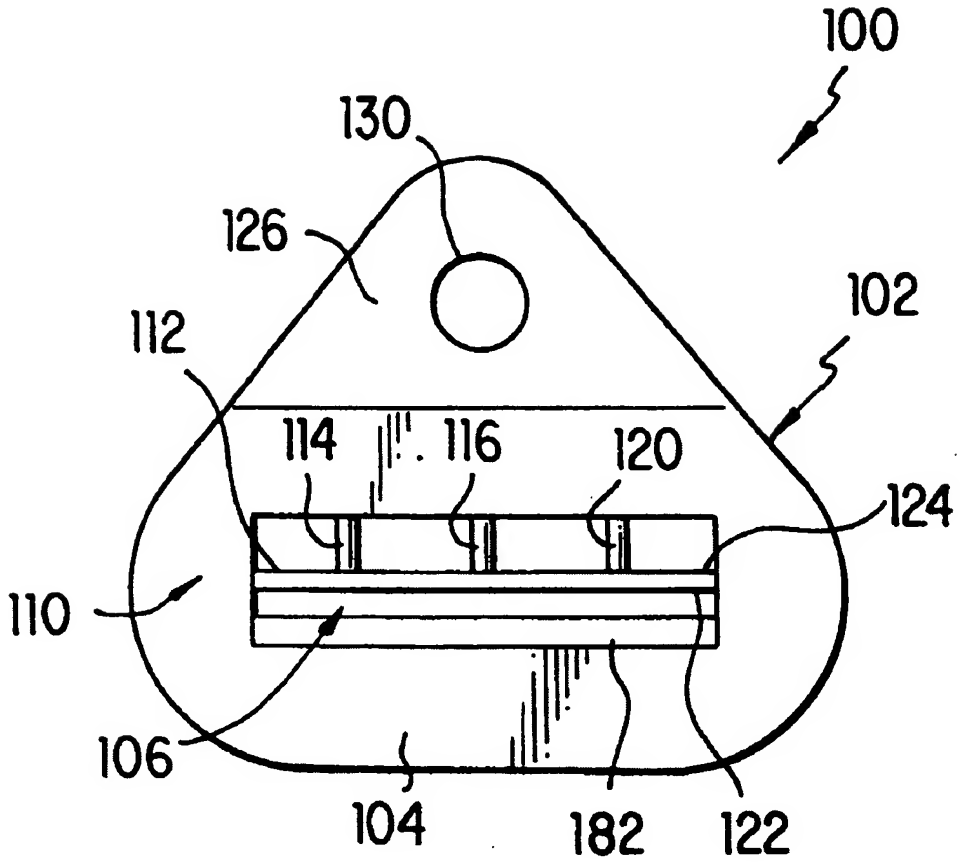


FIG. 5

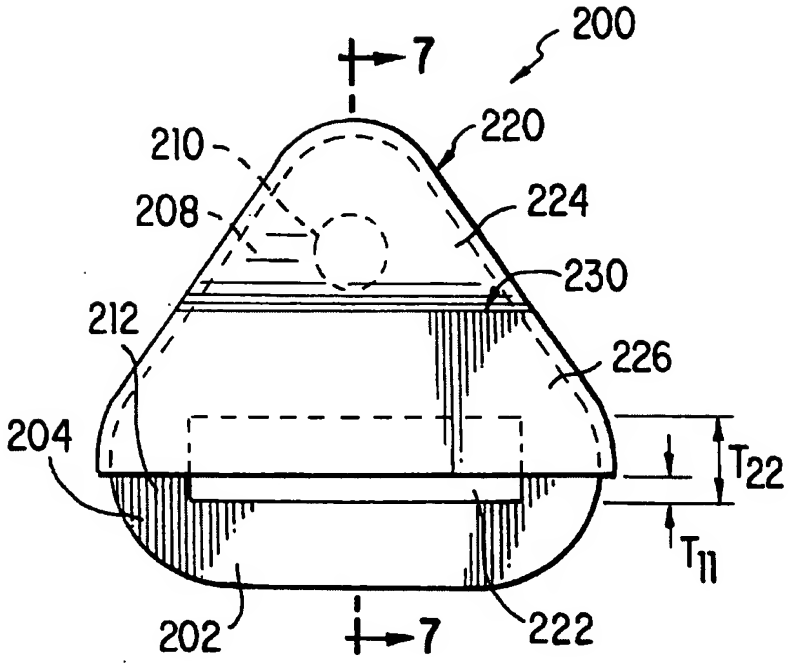


FIG. 6

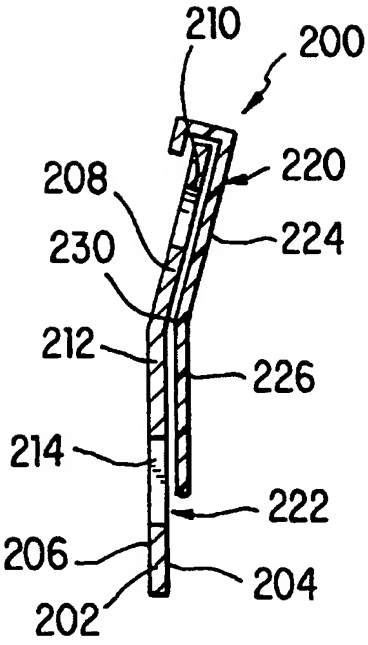


FIG. 7

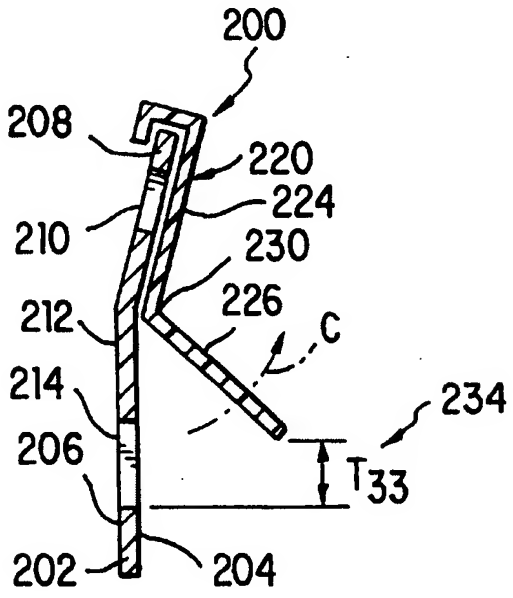


FIG. 8

GUIDE FITTING FOR INFLATABLE VEHICULAR SAFETY BELT

BACKGROUND OF THE INVENTION

This invention relates generally to vehicular restraint systems and, more particularly, to guide fittings for use in association with an inflatable vehicular safety belt.

It is common for various vehicles, such as automobiles, to incorporate or employ restraint systems in an effort to protect passengers in the event of an emergency such as a vehicular collision. Typical vehicular restraint systems commonly incorporate one or more safety belts, oftentimes referred to as "seat belts," in order to restrain an occupant such as to prevent, reduce or minimize the possibility of the occupant contacting or striking various portions of interior of the vehicle such as the instrument panel, steering wheel, door or the like in a forcible manner.

Common safety belt restraint systems include a lap belt, such as designed to extend over the lap of a seated occupant, and a torso belt such as designed to extend diagonally across the upper torso of a seated occupant. Such restraint systems also commonly include a torso belt retractor mounted on, near or adjacent the door pillar most near the respective door-adjacent front seat occupant. Typically, torso belts are designed to exit the retractor and travel along the associated pillar where the belt extends through a guide fitting supported on the vehicle pillar or the like. The torso belt is then slidably passed through a hole or opening provided in the guide fitting. The guide fitting thus serves to slidably guide and deflect the torso belt diagonally downward across the upper torso of the occupant.

Should the seat belt webbing become twisted in or at such a guide fitting, it may become impossible to apply the webbing correctly. In addition, such twisting may impede slidable (e.g., back-and-forth) movement of the belt through the fitting such as is generally desired to provide increased comfort to a wearer while still providing the desired level of occupant protection. Accordingly, the hole or opening provided in such fittings for the slidable passage of the safety belt therethrough is commonly designed and sized to avoid or prevent the undesired twisting of the associated safety belt.

In practice, safety belts used in such systems have conventionally taken the form of a strip of fibrous webbing. While the use of such safety belts has been generally effective in avoiding or reducing injuries to vehicle occupants, the restraint or protection afforded by such use of safety belts has been subject to certain limitations. For example, in common seat belt apparatuses of this kind, the width of the belt webbing cannot be made very large and therefore comparatively large loads may be undesirably concentrated or focused over a relatively small limited contact area of the belt with the occupant. The concentration or focusing of such loads can, if not otherwise addressed, undesirably result in or increase the possibility of injury to the associated vehicle occupant.

To reduce or minimize the occurrence of such situations, inflatable safety belts have been proposed and developed. Inflatable safety belts typically include the shape or form of an inflatable bag or cushion. Inflatable safety belts are commonly designed, upon actuation, to inflate or expand in a matter of no more than a few milliseconds with an inflation fluid, e.g., a gas, produced or supplied by a device commonly referred to as an inflator. As will be appreciated, upon inflation or expansion of such a safety belt, the kinetic energy of the associated occupant can favorably be distributed over the wider contact area provided by the inflated safety belt. As a consequence of such load dispersal, the possibility of injury to an associated vehicle occupant can be desirably reduced or minimized.

While the use of inflatable safety belts may afford various such advantages, the use of such inflatable safety belts may raise various complications in design and implementation. For example, as set forth above, the size, e.g., thickness, of the guide hole or opening provided in fittings employed with safety belts is commonly restricted or limited such as to avoid or prevent the undesired twisting of the associated safety belt. Consequently, where the safety belt is inflatable, proper or desired inflation of such a belt may be undesirably restricted or limited due to the limited thickness of the belt hole or opening in the guide fitting. For example, the free flow or passage of inflation fluid, e.g., gas, into or through the inflatable safety belt may be restricted by such a guide fitting so as to impair reliable and complete realization of the beneficial utilization of inflatable safety belts in the distribution of loads over the wider contact area provided by the inflated safety belt.

In view of the above, there is a need and a demand for an improved guide fitting for use in association with an inflatable vehicular safety belt.

SUMMARY OF THE INVENTION

A general object of the invention is to provide an improved guide fitting for use in association with an inflatable vehicular safety belt.

A more specific objective of the invention is to overcome one or more of the problems described above.

The general object of the invention can be attained, at least in part, through a specified fitting adapted for pivotal mounting onto a vehicle and for the guiding of an inflatable torso safety belt therethrough. In accordance with one preferred embodiment of the invention, such a fitting desirably includes a plate member having a first generally planar portion. The first generally planar portion defines a clearance opening of selected thickness wherethrough the inflatable torso safety belt is passed to permit slidable movement thereof. The plate member also includes a compressible clearance opening edge portion which is compressible in the plane of the plate member first portion upon inflation of the inflatable torso safety belt thereagainst to selectively change the thickness of the clearance opening.

The prior art generally fails to provide as effective and efficient as desired guide fittings for use in association with inflatable safety belts. Thus, the prior art has generally suffered from or resulted in either or both limiting the use of such inflatable safety belts as well as limiting the effectiveness of such inflatable safety belts when used.

The invention further comprehends, in accordance with another preferred embodiment of the invention, such a fitting which includes a plate member defining first and second opposed plate faces with an attachment through-hole opening adapted for mounting of the fitting onto a vehicle. The plate member includes a first generally planar portion which defines a clearance hole having a preselected thickness for passage of the inflatable safety belt therethrough. The fitting also includes a cover element secured to the plate member in covering relationship relative to the attachment through-hole opening and at least a portion of the first plate face, including a portion of the clearance hole, to define a clearance opening. The clearance opening has a thickness no greater than the preselected thickness of the clearance hole. The inflatable safety belt is permitted to pass through the

clearance opening to permit slidable movement thereof. At least a portion of the cover element in covering relationship relative to a portion of the clearance hole is deformable upon inflation of the inflatable torso safety belt thereagainst to selectively change the thickness of the clearance opening.

Other objects and advantages will be apparent to those skilled in the art from the following detailed description taken in conjunction with the appended claims and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a fragmentary schematic of a vehicular restraint system installation incorporating a guide fitting, in accordance with one embodiment of the invention, in association with an inflatable torso safety belt, and wherein the restraint system is in an activated state, e.g., the torso safety belt is at least partially inflated.

FIG. **2** is front plan view schematic of a guide fitting in accordance with one preferred embodiment of the invention in an at rest or static state.

FIG. **3** is an enlarged simplified cross sectional view schematic of the guide fitting shown in FIG. **2**, taken substantially along the line **3**—**3** of FIG. **2** and viewed in the direction of the arrows.

FIG. **4** is an enlarged simplified cross sectional view schematic of the guide fitting shown in FIG. **2**, but now shown in an activated or compressed state.

FIG. **5** is a simplified cross sectional view schematic, similar to the view shown in FIG. **3**, of a guide fitting in accordance with another preferred embodiment of the invention in an at rest or static state.

FIG. **6** is a front plan view schematic of a guide fitting in accordance with another preferred embodiment of the invention in an at rest or static state.

FIG. **7** is a simplified cross sectional view schematic of the guide fitting shown in FIG. **6**, taken substantially along the line **7**—**7** of FIG. **6** and viewed in the direction of the arrows.

FIG. **8** is a simplified cross sectional view schematic of the guide fitting shown in FIG. **6**, but now shown in an activated state.

DETAILED DESCRIPTION OF THE INVENTION

The present invention, as is described in more detail below, provides an improved guide fitting for use in association with an inflatable vehicular safety belt. More particularly, the invention provides a fitting adapted for pivotal mounting onto a vehicle and for the guiding of an inflatable torso safety belt through a clearance hole of adjustable thickness provided in the fitting.

Turning to FIG. **1**, there is illustrated a vehicle, generally designated by the reference numeral **10**, wherein is situated a restraint system **12**, in accordance with one embodiment of the invention. The vehicle **10** includes an interior portion **14**, having a seat **16**, a B-pillar **18** with a trim portion **20**, and an outer body wall **22**.

As shown, the restraint system **12** is designed to properly restrain a vehicle occupant seated in the seat **16**. The restraint system **12** is, as described in greater detail below, shown in an activated state, such as to effectively restrain the occupant in an emergency situation, such as a vehicle accident or collision. The restraint system **12** is generally composed of an inflatable torso safety belt **24**, a conventional lap seat belt **26** or the like and a locking buckle assembly **30**. The locking buckle assembly **30** includes a latch plate or buckle tongue device **32**, to which one end of each of the inflatable torso safety belt **24** and the lap seat belt **26** is attached or fixed, such as in a manner known in the art. The locking buckle assembly **30** also includes a locking buckle **34**, such as fixedly joined or extending from the vehicle floor, and to which the buckle tongue device **32** can be appropriately coupled such as in a manner known in the art.

The restraint system **12** includes, in association with the lap belt **26**, a lap belt retractor device **36** such as situated near or adjacent the vehicle floor, as is known in the art.

The restraint system **12** further includes, in association with the inflatable torso safety belt **24**, a torso safety belt retractor **40**, an inflator device **42** and a conduit **44** for the fluid communication of inflation fluid from the inflator device **42** into the inflatable torso safety belt **24**. If desired and as shown, either or both the torso safety belt retractor **40** and the inflator device **42** can be advantageously placed in or stored along the vehicle B-pillar **18**, such as between the interior trim **20** and the outer body wall **22**.

The restraint system **12** still further includes a guide fitting **46**, such as described in greater detail below and such as pivotally mounted or fixed to the vehicle **10** at a predetermined position above the seat **16**, such as at or near the B-pillar **18**. The guide fitting **46** permits the slidable movement of the inflatable torso safety belt **24** therethrough such as may be desired or required to properly provide vehicle occupant protection while doing so in a manner which is of reduced intrusiveness to the riding comfort of the occupant.

Now turning to FIGS. **2**–**4**, there is illustrated a guide fitting **50** in accordance with one preferred embodiment of the invention. More particularly, the guide fitting **50** is shown in FIGS. **2** and **3** in an at rest or static state and in FIG. **4** in an activated state.

The guide fitting **50** includes a plate member **52** having a first portion **54** which is generally planar in form, with the plane of such first portion **54** generally designated A and shown in FIG. **3**. The first generally planar portion **54** defines a clearance opening **56** wherethrough an inflatable torso safety belt (not shown) can be passed to permit the slidable movement thereof. The clearance opening **56** has an initial or at rest selected thickness designated T_1, shown in FIG. **3**.

The plate member **52** includes a clearance opening edge portion **60** generally compressible in the plane A of the first portion **54** upon inflation of an associated inflatable torso safety belt (not shown) thereagainst to selectively change the thickness of the clearance opening **56**. More particularly, the compressible clearance hole edge portion **60** comprises a contact element **62** and one or more compressible elements **64**, **66** and **70**.

The contact element **62** has a first side **72**, such as adapted to be disposed adjacent an associated inflatable torso safety belt, and a second side **74** such as adapted to be in contact or otherwise adjacent the one or more compressible elements **64**, **66**, and **70**. The contact element **62**, in accordance with the invention and as may be desired, can be formed or made of a compressible material or, alternatively, a non-compressible material. In accordance with one preferred embodiment, the contact element desirably is in the form of a roller such as may simplify and enhance the slidable movement of a safety belt in association therewith.

In accordance with the broader practice of the invention, various compressible materials can be used to form or create

suitable compressible elements. For example, in accordance with particular preferred embodiments of the invention, such compressible materials may desirably take the form of one or more spring elements such as in the form of a metal spring or one or more compressible foam elements such as constructed of a compressible foam, such as generally known in the art.

Further, while the guide fitting **50** is illustrated as having three compressible elements, those skilled in the art and guided by the teachings herein provided will appreciate that particular embodiments of the invention may include a fewer or greater number of compressible elements as may be desired or required for particular applications and performance requirements.

The guide fitting plate member **52** also includes a second generally planar portion **76** such as angularly disposed relative to the first generally planar portion **54** and continuously extending therefrom. The second generally planar portion **76** includes an attachment opening **80** such as may be included to permit or allow the mounting of the guide fitting **50** onto a vehicle such as in a pivotal or rotatable manner, such as is known in the art.

FIG. **4** illustrates the guide fitting **50** in an activated or compressed state. More particularly, one or more, preferably each, of the compressible elements **64**, **66** and **70**, respectively, has been compressed such as to result in the clearance opening **56** having an enlarged or increased thickness, designated T_2, where T_2 is greater than T_1. As will be appreciated, such an enlarged clearance opening will generally more easily permit the desired passage of an associated inflatable safety belt therethrough, even when such safety belt is in an at least partially inflated condition or state.

FIG. **5** illustrates a guide fitting **100** in accordance with another preferred embodiment of the invention. The guide fitting **100** is generally similar to the guide fitting **50** described above in that it includes a plate member **102** having a first portion **104** which defines a clearance opening **106** wherethrough an inflatable torso safety belt (not shown) can be passed to permit the slidable movement thereof. The plate member **102** also includes a clearance opening edge portion **110** generally compressible in the plane of the first portion **104** upon inflation of an associated inflatable torso safety belt thereagainst and such as to selectively change the thickness of the clearance opening **106**. More particularly, the compressible clearance opening edge portion **110** comprises a contact element **112** and one or more compressible elements **114**, **116** and **120**.

The contact element **112** has a first side **122**, such as adapted to be disposed adjacent an associated inflatable torso safety belt, and a second side **124** such as adapted to be in contact or otherwise adjacent the one or more compressible elements **114**, **116**, and **120**. The contact element **112**, in accordance with the invention and as may be desired, can be formed or made of a compressible material or, alternatively, a non-compressible material. In accordance with one preferred embodiment, the contact element desirably is in the form of a roller such as may simplify and enhance the slidable movement of a safety belt in association therewith.

The guide fitting plate member **102** also includes a second generally planar portion **126** such as angularly disposed relative to the first generally planar portion **104** and continuously extending therefrom. The second generally planar portion **126** includes an attachment opening **130** such as may be included to permit or allow the mounting of the guide fitting **100** onto a vehicle such as in a pivotal or rotatable manner, such as is known in the art.

The guide fitting **100**, however, primarily differs from the guide fitting **50** described above in that the guide fitting **100** includes a roller element **182** disposed opposite the contact element **112**, relative to the clearance opening **106**.

Thus, it is to be appreciated that guide fittings in accordance with the invention can include roller elements either as a part of a compressible clearance hole edge portion contact element, or an oppositely disposed a compressible clearance opening edge portion relative to a respective clearance opening or both, as may be desired in particular applications.

Now turning to FIGS. **6–8** there is illustrated a guide fitting **200** in accordance with another preferred embodiment of the invention. More particularly, the guide fitting **200** is shown in FIGS. **6** and **7** in an at rest or static state and in FIG. **8** in an activated state.

The guide fitting **200** includes a plate member **202** defining first and second opposed plate faces **204** and **206**, respectively. The plate member **202** includes a generally planar portion **208** which includes an attachment through-hole opening **210** adapted for mounting of the guide fitting **200** onto an associated vehicle in a manner such as known in the art.

The plate member **202** also includes a generally planar portion, designated by the reference character **212**. The plate member planar portions **208** and **212** are generally continuously extending and angularly disposed relative to each other, similar to the planar portions **54** and **76** of the guide fitting **50** described above, for example.

The plate member planar portion **212** defines a clearance hole **214** adapted to permit passage of an associated inflatable torso safety belt therethrough. The clearance hole **214** is of a preselected thickness designated T_{11}.

The guide fitting **200** also includes a cover element, designated **220**. It is generally well known to include a cover element relative to a safety belt guide fitting such as to improve the appearance of corresponding restraint system installations such as by better or more closely matching the appearance of other components or aspects of the interior trim of a respective vehicle. As will be described in greater detail below and in accordance with the preferred practice of this aspect of the invention, the cover element **220** also desirably serves to functionally enhance the guide fitting **200** and the use thereof.

The cover element **220** is desirably secured to the plate member **202** in a manner such as known in the art. In a preferred embodiment of this aspect of the invention, the cover element **220** is placed in covering relationship relative to the attachment through-hole opening **210** and at least a portion of the first plate face **204**, including a portion of the clearance hole **214** to define a clearance opening **222**, shown in FIGS. **6** and **7**. The clearance opening **222** has a thickness (designated T_{22}) which is no greater than the preselected thickness of the clearance hole **214** (T_{11}) and wherethrough the associated inflatable safety belt is adapted to be passed to permit the slidable movement of such safety belt. More particularly, the cover element **220** includes a first or upper section **224** and a second or lower section **226**. The cover element lower section **226** at least partially overlies or extends over the clearance hole **214** such as to thereby at least in part define the clearance opening **222**.

The cover element upper and lower sections **224** and **226**, respectively, are connected or otherwise joined together at or by a hinge region **230**. The hinge region **230** permits the

hinged rotation or movement of the cover element lower section **226** relative to the cover element upper section **224** and consequently relative to the plate member **202** as such cover element upper section **224** is, in accordance with a preferred embodiment of the invention, desirably secured or fixed relative to such plate member **202**.

FIG. **8** illustrates the guide fitting **200** in an activated state, such as when the associated inflatable torso safety belt has at least in part been inflated such that the belt assumes a greater thickness. In such activated state, the cover element lower section **226** is desirably rotated, at least in part, in a direction away from the clearance hole **214**, as signified by the arrow C such as to form an enlarged clearance opening **234** having a thickness designated T_{33}, where T_{33} is greater than T_{22}.

As will be appreciated, such cover element rotation is desirably facilitated as the cover element upper and lower sections **224** and **226**, respectively, are connected or otherwise joined together at or by the hinge region **230**. In particular, though the cover element upper section **224** is fixed relative to the plate member **202**, the lower section **226** hingedly extends therefrom to permit the desired rotation of the cover element in a direction away from the clearance hole **214**. Further, as described above, such an enlarged clearance opening will generally more easily permit the desired passage of an associated inflatable safety belt therethrough, even when such safety belt is in an at least partially inflated condition or state.

Thus, the invention provides vehicular restraint systems and associated guide fittings of improved effectiveness and efficiency. More particularly, the invention provides a guide fitting which includes a clearance opening of selectively changeable thickness wherethrough the inflatable torso safety belt can be passed to permit slidable movement thereof even when the inflatable safety belt is in an at least partially expanded or inflated state. As a result, the invention may more readily allow or permit the more widespread and effective use of such inflatable safety belts and such as may result in the greater or more effective protection of vehicle occupants.

The invention illustratively disclosed herein suitably may be practiced in the absence of any element, part, step, component, or ingredient which is not specifically disclosed herein.

While in the foregoing detailed description this invention has been described in relation to certain preferred embodiments thereof, and many details have been set forth for purposes of illustration, it will be apparent to those skilled in the art that the invention is susceptible to additional embodiments and that certain of the details described herein can be varied considerably without departing from the basic principles of the invention.

What is claimed is:

1. A fitting adapted for pivotal mounting onto a vehicle and for the guiding of an inflatable torso safety belt therethrough, the fitting comprising:

a plate member having a first generally planar portion defining a clearance opening of selected thickness for the inflatable torso safety belt to pass through and permit slidable movement thereof, the plate member including a base portion to contact with the inflatable torso safety belt and a compressible clearance opening edge portion spaced apart from the base portion by the clearance opening, the compressible clearance opening edge portion compressible in the plane of the plate member first portion for permitting inflation of the inflatable torso safety belt thereagainst to selectively change the thickness of the clearance opening, the compressible clearance hole edge portion comprising a contact element having opposed first and second sides with the first side for disposition adjacent to the inflatable torso safety belt, the compressible clearance hole edge portion also including a compressible element disposed adjacent the second side of the contact element.

2. The fitting of claim **1** wherein:

the contact element comprises a non-compressible material.

3. The fitting of claim **1** wherein:

the contact element comprises a first roller member.

4. The fitting of claim **3** wherein:

the plate member also includes a second roller member disposed opposite the first roller member relative to the clearance opening.

5. The fitting of claim **1** wherein:

the plate member also includes a roller member disposed opposite the compressible clearance opening edge portion relative to the clearance opening.

6. The fitting of claim **1** wherein:

the compressible element comprises at least one spring element.

7. The fitting of claim **1** wherein the plate member additionally comprises a second generally planar portion angularly disposed relative to the first generally planar portion.

8. The fitting of claim **7** wherein the second generally planar portion includes an attachment opening adapted for mounting of the fitting onto a vehicle.

9. A vehicular restraint system comprising the fitting of claim **1** and additionally comprising:

a lap safety belt and

a tongue element to which a first end of the lap safety belt is fixed and for permitting a first end of the inflatable torso safety belt to be fixed thereto.

10. The combination of the fitting of claim **1** and an inflatable torso safety belt adapted to be passed through the clearance opening of the fitting.

11. A fitting adapted for pivotal mounting onto a vehicle and for the guiding of an inflatable torso safety belt therethrough, the fitting comprising:

a plate member having a first generally planar portion defining a clearance opening of selected thickness for the inflatable torso safety belt to pass through and permit slidable movement thereof, the plate member including a compressible clearance opening edge portion compressible in the plane of the plate member first portion for permitting inflation of the inflatable torso safety belt thereagainst to selectively change the thickness of the clearance opening wherein:

the compressible clearance hole edge portion comprises a contact element for disposition adjacent the inflatable torso safety belt and a compressible element for disposition opposite the inflatable torso safety belt relative to the contact element, the compressible element comprising a compressible foam material.

12. A fitting adapted for pivotal mounting onto a vehicle and for the guiding of an inflatable torso safety belt therethrough, the fitting comprising:

a plate member defining first and second opposed plate faces with an attachment through-hole opening adapted for mounting of the fitting onto a vehicle, the plate

member including a first generally planar portion defining a clearance hole having a preselected thickness for passage of the inflatable safety belt therethrough; and

a cover element secured to the plate member in covering relationship relative to the attachment through-hole opening and at least a portion of the first plate face, including a portion of the clearance hole to define a clearance opening having a thickness no greater than the preselected thickness of the clearance hole and for passage of the inflatable safety belt therethrough to permit slidable movement thereof, wherein at least a portion of the cover element in covering relationship relative to a portion of the clearance hole is deformable for permitting inflation of the inflatable torso safety belt thereagainst to selectively change the thickness of the clearance opening wherein the cover element comprises a first section fixed relative to the plate member and a second section hingedly extending from the first section and at least partially overlying the clearance hole for permitting inflation of the inflatable torso safety belt with the cover element second section hingedly rotating to form a clearance opening of increased thickness.

13. The fitting of claim **12** wherein the plate member includes an attachment opening adapted for mounting of the fitting onto a vehicle.

14. A vehicular restraint system comprising the fitting of claim **12** and additionally comprising:

a lap safety belt and

a tongue element to which a first end of the lap safety belt is fixed and for permitting a first end of the inflatable torso safety belt to be fixed thereto.

15. The combination of the fitting of claim **12** and an inflatable torso safety belt adapted to be passed through the clearance opening of the fitting.

* * * * *

Appendix D

Amendment "A", filed August 4, 2006

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of QUIOC ET AL.	)	BELT AND SIDE IMPACT INFLATOR
Serial No.: 10/826,437	)	Attorney Docket: 5702-01051
Filed: April 16, 2004	)	Group Art Unit: 3616
	)	Examiner: L.B. Rosenberg
	)	

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT "A"

Dear Sir:

This paper is filed in response to the Office Action mailed May 4, 2006 in connection with the above-designated application. A response to the Office Action is due August 4, 2006.

Amendments to the Specification begin on page 2 of this paper.

Amendments to the Claims are reflected in the listing of claims which begins on page 3 of this paper.

Remarks/arguments begin on page 9 of this paper.

Amendments to the Specification:

Please replace the paragraph beginning on page 4, line 27 of the specification with the following amended paragraph:

A cylindrical filter 38, preferably a metallic mesh filter, is positioned in inflator body 12, and filters particulate materials generated by the combustion of propellant charges 18 and 28. Filter 38 fills a volume of the housing 12 defined by the cross-section of filter 38 (shown in Figure 6) spanning from a point l_1 to a second point l_2. The longitudinal distance defined by the distance between l_1 and l_2 ranges from about one-fourth to one half of the total length of housing 12, or l_T. Adjustment of the length of the filter 38 therefore increases or reduces the pressure of the gas at the second end 13 and as such, may function as a filter, a gas pressure throttle, and/or a heat sink depending on design criteria. Suitable, exemplary filters are available from Wayne Wire of Kalkaska, Michigan. Filter 38 also serves as a heat sink for hot combustion gases produced during inflator activation, cooling the gases before their ejection into the associated airbelt or airbag. In a preferred embodiment, a perforated disc 30, preferably an expanded metal, is positioned adjacent filter 38, and facilitates the creation of a resident interim gas pressure in inflator body 12 during combustion of the propellant. A nozzle 36 is preferably positioned adjacent disc 30 and secured with inflator body 12 by crimping second end 13, although the nozzle 36 might be threadedly attached to inflator body 12 if desired. An O-ring 39 is preferably circumferential about a portion of nozzle 36, and thereby creates a fluid-tight seal at second end 13. In a preferred embodiment, nozzle 36 includes a substantially cylindrical projection 37 that extends past second end 13. An internally projecting ledge [[38]] is preferably positioned within nozzle 36, and preferably includes a central aperture 40, that may be covered by a conventional burst shim (not shown).

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (currently amended) An inflator comprising:

an inflator body;

a substantially cylindrical booster cup extending in said body, said booster cup having an outer peripheral wall and an end surface extending radially inwardly from said wall;

a plurality of apertures formed in said outer peripheral wall;

a first propellant charge positioned in said booster cup;

a second propellant charge positioned in said inflator body;

an initiator assembly operable to activate said first propellant charge, wherein a combustion thereof initiates a combustion of said second propellant charge and ejection of an inflation gas from said inflator body;

a filter abutting said booster cup end surface;

a perforated disc abutting said filter; and

a nozzle positioned at an end of said inflator and abutting said perforated disc for supplying an inflation gas to the inflatable restraint system.

2. (original) The inflator of claim 1 wherein said inflator body comprises an inner peripheral wall separated from said outer peripheral wall by a substantially annular space; and

said second propellant charge is positioned in said space.

3. (original) The inflator of claim 2 wherein said second propellant charge is positioned substantially adjacent said outer peripheral wall.

4. (original) The inflator of claim 3 wherein said second propellant charge comprises a plurality of propellant tablets.

5. (original) The inflator of claim 3 wherein said second propellant charge substantially fills the space between the outer peripheral wall and the inner peripheral wall of the inflator body.

6. (currently amended) The inflator of claim 5 ~~comprising a~~ wherein said filter ~~constraining~~ constrains said second propellant charge in said space.

7. (currently amended) An inflator for an inflatable restraint system in a vehicle comprising:

an inflator body having first and second ends and an inner peripheral wall;

a booster cup extending in said body and having an outer peripheral wall and an end surface extending inwardly from said outer peripheral wall, said booster cup having a first propellant charge positioned therein;

said inner peripheral wall and said outer peripheral wall are separated by a substantially annular space having a second propellant charge positioned therein;

an initiator assembly disposed proximate said first end and operable to ignite said first propellant charge; ~~and~~

a filter abutting said booster cup end surface;

a perforated disc abutting said filter; and

a nozzle positioned at said second end of said body and abutting said perforated disc, said nozzle ~~and~~ defining a nozzle outlet for supplying an inflation gas to the inflatable restraint system.

8. (canceled) The inflator of claim 7 comprising a filter positioned adjacent said end surface.

9. (currently amended) The inflator of claim [[8]] 7 wherein said body has a total length and an area defined by a cross-section thereof, and said filter has a given length about one-fourth to one-half of the total length of the body, said filter occupying a volume determined by multiplying the cross-section of said body by the length of said filter.

10. (original) The inflator of claim 7 wherein said booster cup is a substantially cylindrical elongate member substantially coaxial with said inflator body.

11. (original) The inflator of claim 10 wherein said booster cup includes a plurality of apertures formed in said outer peripheral wall.

12. (original) The inflator of claim 11 wherein said substantially annular space extends longitudinally in said inflator body from a point proximate said first end up to a point substantially coplanar with said end surface.

13. (currently amended) The inflator of claim [[8]] 7 wherein said filter is substantially cylindrical and includes a substantially cylindrical periphery positioned adjacent said inner peripheral wall, and a substantially planar end positioned flush with said end surface.

14. (currently amended) An inflatable restraint system for a motor vehicle comprising:

an inflatable restraint device;

an inflator operable to provide an inflation gas to said inflatable restraint device, said inflator comprising an elongate substantially cylindrical inflator body having first and second ends and an inner peripheral wall;

an elongate ~~combustion~~ booster cup mounted to said inflator body proximate said first end and extending substantially coaxially therewith, said ~~combustion~~ booster cup having an outer peripheral wall separated from said inner peripheral wall by an annular space, and a plurality of apertures formed in said outer peripheral wall;

a propellant charge positioned in said space;

a filter positioned in said inflator body abutting an end portion of the booster cup , said filter ~~and~~ securing said propellant charge in said space;

a perforated disc abutting said filter; and

a nozzle member proximate said second end of said inflator body and abutting said perforated disc, said nozzle member constraining said filter against axial displacement.

15. (original) The inflatable restraint system of claim 14 wherein said propellant charge comprises a plurality of gas generant tablets positioned in a geometrically ordered fashion in said annular space.

16. (original) The inflatable restraint system of claim 15 wherein said propellant charge comprises a plurality of gas generant tablets stacked adjacently in said annular space and having cylindrical axes oriented substantially perpendicular said inner peripheral wall.

17. (original) The inflatable restraint system of claim 14 wherein said nozzle is threadedly engaged with said inflator body.

18. (original) The inflatable restraint system of claim 14 wherein said filter is secured against said booster cup, thereby constraining said tablets from movement in said annular space.

19. (currently amended) The inflatable restraint system of claim 14 further comprising a propellant charge positioned in said ~~combustion~~ booster cup.

20. (currently amended) The inflatable restraint system of claim 14 further comprising an initiator body within said inflator body proximate said first end;

wherein said ~~combustion~~ booster cup is attached to said initiator body and suspended therefrom, said ~~combustion~~ booster cup supported in said inflator body solely by said attachment with said initiator body.

21. (original) The inflatable restraint system of claim 14 wherein the inflatable restraint device is an airbag.

22. (original) The inflatable restraint system of claim 14 wherein the inflatable restraint device is an airbelt.

23. (currently amended) An inflatable airbelt system for a motor vehicle comprising:

an inflatable airbelt;

an inflator operable to provide an inflation gas to said airbelt, said inflator comprising an inflator body and a booster cup extending in said body, said booster cup having an outer peripheral wall and an end surface extending radially inwardly from said wall;

said booster cup includes a plurality of apertures formed in said outer peripheral wall;

a first propellant charge positioned in said booster cup;

a second propellant charge positioned in said inflator body;

an initiator assembly operable to activate said first propellant charge, wherein a combustion thereof initiates a combustion of said second propellant charge via said apertures;

a filter abutting said booster cup end surface;

a perforated disc abutting said filter; and

a nozzle positioned at an end of said inflator and abutting said perforated disc for supplying an inflation gas to the inflatable restraint system.

24. (original) The airbelt system of claim 23 wherein said booster cup is an elongate substantially cylindrical member oriented substantially coaxially with said inflator body.

25. (original) The airbelt system of claim 24 wherein said inflator body includes an inner peripheral wall spaced from said outer peripheral wall of said booster cup by an annular space;

said second propellant charge positioned in said space.

26. (currently amended) The airbelt system of claim 23 ~~comprising a~~ wherein said filter ~~constraining~~ constrains said second propellant charge in said space.

27. (currently amended) An inflator module for a vehicle occupant protection system comprising:

a module housing;

an inflator positioned in said housing, said inflator comprising a ~~combustion~~ booster cup mounted to said inflator body and extending substantially coaxially therewith, said ~~combustion~~ booster cup having an outer peripheral wall partially defining an annular space and a plurality of apertures formed in said outer peripheral wall;

a propellant charge positioned in said space;

a filter positioned in said inflator ~~body~~ abutting an end portion of said booster cup ~~and~~ for securing said propellant charge in said space;

a perforated disc abutting said filter; and

a nozzle positioned at an end of said inflator and abutting said perforated disc for supplying an inflation gas to the inflatable restraint system.

28. (original) The inflator module of claim 27 wherein said inflator comprises an inflator body having an inner peripheral wall opposing said outer peripheral wall, said inner and outer peripheral walls defining said space.

29. (currently amended) The inflator module of claim 28 wherein said ~~inflator includes a~~ filter member ~~positioned adjacent said combustion cup and constraining~~ constrains said propellant charge in said space.

30. (currently amended) A method of manufacturing a gas generator comprising the steps of:

positioning a ~~combustion~~ booster cup within an elongate substantially cylindrical inflator body;

placing a propellant charge in a space extending between an outer peripheral wall of the ~~combustion~~ booster cup and an inner peripheral wall of the inflator body;

inserting a filter member into the inflator body up to a point at which the filter bears against an end surface of the ~~combustion~~ booster cup; ~~and~~

positioning a perforated disc abutting said filter; and

positioning a nozzle member in the inflator body at a selected axial position and abutting said perforated disc such that the filter is constrained from axial movement between the nozzle member and the ~~combustion~~ booster cup, whereby the filter secures the propellant charge in the space.

31. (original) The method of claim 30 wherein the step of placing a propellant charge in the space comprises placing propellant tablets therein.

32. (original) The method of claim 31 wherein the step of placing the propellant charge in the space comprises placing the propellant tablets therein in a geometrically ordered fashion up to a point substantially coplanar with an end surface of the combustion cup.

33. (original) The method of claim 30 wherein the filter length is sized to reduce or increase a gas pressure resulting from activation of the gas generator.

34. (original) A gas generator manufactured according to the method of claim 30.

Remarks

In the Office Action mailed on May 4, 2006, the Examiner objected to certain informalities in the specification; rejected claims 14-22 and 27-29 under 35 U.S.C. § 112, second paragraph, as being indefinite; rejected claims 1-21 and claims 27-34 under 35 U.S.C. 102(b) as being anticipated by Kirchoff et al., U.S. Patent No. 3,972,545; rejected claims 1-6 and claims 23-29 under 35 U.S.C. 102(b) as being anticipated by Adams et al., U.S. Patent No. 4,437,681; rejected claims 1-12, 14-16, 19-21, and 27-34 35 under 35 U.S.C. 102(b) as being anticipated by Ruckdeschel et al., U.S. Patent No. 6,196,583; and rejected claims 14 and 22 under 35 U.S.C. 103(a) as being unpatentable over Takeuchi, U.S. Patent No. 6,145,873, in view of Ruckdeschel et al. '583.

Regarding the Examiner's objections to informalities in the specification, the specification has been amended to delete any use of reference numeral 38 in conjunction with the "internally projection ledge" in the inflator nozzle.

Claims 14 and 27 have been amended to address the Examiner's rejections under 35 U.S.C. § 112.

Regarding the Examiner's rejection of claim 1 as being anticipated by Kirchoff et al. '545, Applicants respectfully submit that claim 1 is not anticipated by Kirchoff et al. '545 because the reference does not disclose all of the elements recited in the claim. Tube 34 of the cited reference does *not* disclose "...a plurality of apertures formed in said outer peripheral wall", as recited in claim 1.

Regarding the Examiner's rejections of claim 9 under 35 U.S.C. 102(b) as being anticipated by Kirchoff et al. '545 and also as being anticipated by Ruckdeschel et al. '583, the Examiner's attention is directed to MPEP § 2125, which states in part:

> "When the reference does not disclose that the drawings are to scale and is silent as to dimensions, arguments based on measurement of the drawing features are of little value. See Hockerson-Halberstadt, Inc. v. Avia Group Int'l, 222 F.3d 951, 956, 55 USPQ2d 1487, 1491 (Fed. Cir. 2000) (The disclosure gave no indication that the drawings were drawn to scale. "[I]t is well established that patent drawings do not define the precise proportions of the elements and may not be relied on to show particular sizes if the specification is completely silent on the issue.")."

The disclosures of both Kirchoff et al. '545 and Ruckdeschel et al. '583 are silent as to the dimensions of the devices disclosed therein, and are also silent as to whether the drawings shown therein are to scale. Thus, the drawings in the references cannot be relied upon to show the precise proportions of the objects depicted therein. In view of this, Applicants submits that the Examiner's rejections of claim 9 under 35 U.S.C. 102(b) as being anticipated by Kirchoff et al. '545 and also as being anticipated by Ruckdeschel et al. '583 are unsupported.

Independent claims 1, 7, 14, 23, 27, and 30 have been amended to clarify the distinctions between the present invention and the cited references. It is submitted that none of the cited references include all of the features recited in the amended independent claims.

Claim 8 has been canceled. Claim 6 has been amended so as to be consistent with amended independent claim 1, from which claim 6 depends. Claims 9 and 13 have been amended so as to depend from amended claim 7. Claims 19 and 20 have been amended so as to be consistent with amended independent claim 14, from which claims 19 and 20 depend. Claim 26 has been amended so as to be consistent with amended independent claim 23, from

which claim 26 depends. Claim 29 has been amended so as to be consistent with amended independent claim 27, from which claim 29 depends.

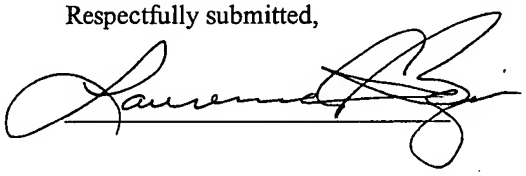
In response to the Examiner's rejection of claims 14 and 22 under 35 U.S.C. 103(a) as being unpatentable over Takeuchi, U.S. Patent No. 6,145,873, in view of Ruckdeschel et al. '583, Applicants submit that there is no motivation or suggestion to combine the teachings of the references. Takeuchi '873 does not disclose any details regarding the structure of inflator 26 incorporated into the airbelt device. Thus, there is no basis for comparing inflator 26 of Takeuchi '873 to the device disclosed in Ruckdeschel et al. '583, and no basis for evaluating any possible advantages to be gained from combining the references. Thus, there is no incentive apparent from the references for combining the references. In addition, even if the cited references were to be combined as suggested by the Examiner, no combination of the references would include all of the elements recited in amended claim 14. For these reasons, the Examiner' rejection of claims 14 and 22 under 35 U.S.C. 103(a) as being unpatentable over Takeuchi, U.S. Patent No. 6,145,873, in view of Ruckdeschel et al. '583 should be withdrawn.

In addition, the inflator of the present invention provides important advantages over the devices disclosed in the cited references. The present invention provides an inflator design incorporating a nozzle, wherein the design is simpler, more compact, and easier to manufacture than the devices disclosed in the cited references.

Applicants submit that, as claim 1 is deemed patentable, claims 2-6 are also patentable as they depend from claim 1. Also, as claim 7 is deemed patentable, claims 9-13 are also patentable as they depend from claim 7. Also, as claim 14 is deemed patentable, claims 15-22 are also patentable as they depend from claim 14. Also, as claim 23 is deemed patentable, claims 24-26 are also patentable as they depend from claim 23. Also, as claim 27 is deemed patentable, claims 28-29 are also patentable as they depend from claim 27. Also, as claim 30 is deemed patentable, claims 31-34 are also patentable as they depend from claim 30.

In view of the above amendments and remarks, the Applicants respectfully submit that all rejections of record have been overcome. The Applicants respectfully requests favorable reconsideration and allowance of the present application.

Respectfully submitted,



Laurence C. Begin
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Dated: AUGUST 4, 2006

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Appendix E

Final Office Action (paper no. 20061004), mailed October 16, 2006

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/826,437	04/16/2004	Eduardo L. Quioc	5702-01051	1043

7590 10/16/2006

L.C. Begin & Associates, PLLC
PMB 403
510 Highland Avenue
Milford, MI 48381

EXAMINER	
ROSENBERG, LAURA B	

ART UNIT	PAPER NUMBER
3616	

DATE MAILED: 10/16/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

1
2

10-27

DRT-12-16
1-16

NT-11-16
12-16

FILE FORMAL DRAWINGS
W/ AMEND

Office Action Summary	Application No.	Applicant(s)	
	10/826,437	QUIOC ET AL.	
	Examiner	Art Unit	
	Laura B. Rosenberg	3616	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *04 August 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-7 and 9-34* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-7 and 9-34* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

chment(s)

] Notice of References Cited (PTO-892)

] [redacted] of Draftsperson's Patent Drawing Review (PTO-948)

Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____.

4)☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.

5)☐ Notice of Informal Patent Application

6)☐ Other: _____.

DETAILED ACTION

1. This office action is in response to the amendment filed 04 August 2006, in which claims 1, 6, 7, 9, 13, 14, 19, 20, 23, 26, 27, 29, and 30 were amended and claim 8 was canceled.

Claim Objections

2. Claims 1, 23, 27, and 32 are objected to because of the following informalities:

"the inflatable restraint system" should be changed to --*an* inflatable restraint system-- (claim 1, line 14);

"the inflatable restraint system" should be changed to --the inflatable *airbelt* system-- (claim 23, line 14);

"said inflator body" should be changed to --*an* inflator body-- (claim 27, line 4);

"the inflatable restraint system" should be changed to --the *vehicle occupant protection* system-- (claim 27, line 11);

"the combustion cup" should be changed to --the *booster* cup-- (claim 32, line 3).

Appropriate correction is required.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1-7, 9-21, and 27-34 are rejected under 35 U.S.C. 102(b) as being anticipated by Kirchoff et al. (3,972,545). Kirchoff et al. disclose an inflator (including #5) able to be used with an inflatable restraint system (for example, an airbag), comprising:

- Inflator body (including #6) having a first end (for example, left end in figure 1) and a second end (for example, right end in figure 1)
- Elongate, substantially cylindrical booster cup (including #34) extending in the body, oriented substantially coaxially with the inflator body, and having an outer peripheral wall (for example, outer cylindrical wall) and an end surface (for example, right end in figure 1) extending radially inwardly from the wall
- Plurality of apertures formed in the outer peripheral wall (apertures formed when peripheral wall of tube is ruptured by squib and pyrotechnic material)
- First propellant charge (including #21) positioned in the booster cup
- Second propellant charge (including #18) positioned in the inflator body
- Initiator assembly (including squibs #19, 20) able to activate the first propellant charge, a combustion thereof initiating a combustion of the second propellant charge and ejection of an inflation gas from the inflator body (via discharge orifice #13)
- Inflator body comprises an inner peripheral wall separated from the outer peripheral wall by a substantially annular space, the second propellant charge being positioned in the space, substantially adjacent the outer peripheral wall (best seen in figure 1)

- Second propellant charge comprise a plurality of propellant tablets (including #18) and substantially fills the space between the outer peripheral wall and the inner peripheral wall of the inflator body (best seen in figure 1)
- Filter (including #22, 24, 28, 29, 30, 32) constraining the second propellant charge in the space (best seen in figure 1)
- Nozzle (including #12) positioned at the second end of the body and defining a nozzle outlet (including #13) able to supply an inflation gas to the inflatable restraint system
- Filter abutting the booster cup end surface (in particular, filter component #22)
- Body has a total length and an area defined by a cross-section, and the filter has a given length about one-half (though not necessarily drawn to scale, filter appears to be about one-half of the total length of the body, as seen in figure 1), the filter occupying a volume determined by multiplying the cross-section of the body by the length of the filter
- Substantially annular space separating inner peripheral wall and outer peripheral wall extends longitudinally in the inflator body from a point proximate the first end up to a point substantially coplanar with the end surface of the booster cup (best seen in figure 1)
- Nozzle constrains the filter against axial displacement (for example, via contact of right end of filter with left end of nozzle including perforated annulus #33, as seen in figure 1)

- Tablets (including #18) positioned in a geometrically ordered fashion in the annular space (for example, as seen in figure 1)
- Tablets (including #18) stacked adjacently in the annular space and having cylindrical axes oriented substantially perpendicular the inner peripheral wall (for example, as seen in figure 1)
- Booster cup attached to initiator body (including plug at left end of squib #19 that is attached to end cap #7) and suspended therefrom, being supported in the inflator body solely by the attachment to the initiator body (best seen in figure 1)
- Filter is substantially cylindrical and includes a substantially cylindrical periphery positioned adjacent the inner peripheral wall (best seen in figure 1) and a substantially planar end (for example, left end of filter portion #22) positioned flush with the end surface (right end of booster cup)
- Nozzle is threadingly engaged with the inflator body (at screw threads #11)
- Filter length is sized to change the gas pressure resulting form activation of the gas generator (for example, column 4, lines 9-16)
- Perforated disk (for example, including #31, 33) abutting the filter (for example, abutting right end of filter in figure 1)
- Nozzle (including #12) abutting perforated disc (best seen in figure 1)

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 14 and 22-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schneider et al. (6,279,945) in view of Kirchoff et al. (3,972,545). Schneider et al. disclose an inflatable restraint system (for example, an inflatable safety belt system) able to be used with a motor vehicle (including #10), comprising:

- Inflatable restraint device (including inflatable safety belt #24)
- Inflator (including #42) able to provide an inflation gas to the inflatable restraint device and comprising an elongate substantially cylindrical inflator body (can be seen in figure 1) having a first end (for example, bottom end as seen in figure 1) and a second end (for example, top end as seen in figure 1) and an inner peripheral wall (not shown, but would be interior wall of inflator body)
- Inflatable restraint is an airbelt (including #24)

Schneider et al. do not specifically disclose all of the interior features of the inflator, such as a booster cup, apertures, propellant charge, filter, or nozzle member.

Kirchoff et al. teach an inflatable restraint system, as set forth above, including an elongate booster cup, plurality of apertures, propellant charge, filter, and nozzle member. It would have been obvious to one skilled in the art at the time that the invention was made to modify the inflator of Schneider et al. such that it comprised booster cup, apertures, propellant charge, filter, and nozzle as claimed in view of the teachings of Kirchoff et al. so as to provide a practical, reliable, gas-generating system that will automatically respond to a signal and adjust the rate of inflation to be

proportionate to the severity of impact, as well as other benefits (Kirchoff et al.: "Summary of the Invention").

Response to Arguments

7. Applicant's arguments filed 04 August 2006 have been fully considered but they are not persuasive. Regarding claim 9, MPEP § 2125 states in part:

> When the reference does not disclose that the drawings are to scale and is silent as to dimensions, arguments based on measurement of the drawing features are of little value. See Hockerson-Halberstadt, Inc. v. Avia Group Int 'l, 222 F.3d 951, 956, 55 USPQ2d 1487, 1491 (Fed. Cir. 2000) (The disclosure gave no indication that the drawings were drawn to scale. "[I]t is well established that patent drawings do not define the precise proportions of the elements and may not be relied on to show particular sizes if the specification is completely silent on the issue."). ***However, the description of the article pictured can be relied on, in combination with the drawings, for what they would reasonably teach one of ordinary skill in the art. In re Wright, 569 F.2d 1124, 193 USPQ 332 (CCPA 1977).***

Per the italicized portion above, while the drawings in the Kirchoff et al. reference are not necessarily drawn to scale, one of ordinary skill in the art could determine from the description and the drawings that the filter has a given length "about one-fourth to one-half of the total length" of the inflator body.

Conclusion

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Laura B. Rosenberg whose telephone number is (571) 272-6674. The examiner can normally be reached on Monday-Friday 7:00am-3:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul Dickson can be reached on (571) 272-6669. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Laura B. Rosenberg

Laura B Rosenberg
Patent Examiner
Art Unit 3616

LBR

10/11/06

Appendix F

Amendment After Final Office Action Under 37 CFR § 1.116, filed February 15, 2007

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of QUIOC ET AL.	)	BELT AND SIDE IMPACT INFLATOR
Serial No.: 10/826,437	)	Attorney Docket: 5702-01051
Filed: April 16, 2004	)	Group Art Unit: 3616
	)	Examiner: L.B. Rosenberg
	)	

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

RESPONSE TO FINAL OFFICE ACTION AND REQUEST FOR RECONSIDERATION UNDER 37 CFR § 1.116(a)

Dear Sir:

This paper is filed in response to the final Office Action mailed on October 16, 2006 in connection with the above-designated application. A shortened statutory period for reply to the final Office Action expired on January 16, 2007. A one-month extension is requested herein, bringing the due date for the response to February 16.

Amendments to the Claims are reflected in the listing of claims which begins on page 2 of this paper.

Remarks/arguments begin on page 7 of this paper.

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (currently amended) An inflator comprising:

an inflator body;

a substantially cylindrical booster cup extending in said body, said booster cup having an outer peripheral wall and an end surface extending radially inwardly from said wall;

a plurality of apertures formed in said outer peripheral wall;

a first propellant charge positioned in said booster cup;

a second propellant charge positioned in said inflator body;

an initiator assembly operable to activate said first propellant charge, wherein a combustion thereof initiates a combustion of said second propellant charge and ejection of an inflation gas from said inflator body;

a filter abutting said booster cup end surface;

a perforated disc abutting said filter; and

a nozzle positioned at an end of said inflator and abutting said perforated disc for supplying an inflation gas to [[the]] an inflatable restraint system.

2. (original) The inflator of claim 1 wherein said inflator body comprises an inner peripheral wall separated from said outer peripheral wall by a substantially annular space; and

said second propellant charge is positioned in said space.

3. (original) The inflator of claim 2 wherein said second propellant charge is positioned substantially adjacent said outer peripheral wall.

4. (original) The inflator of claim 3 wherein said second propellant charge comprises a plurality of propellant tablets.

5. (original) The inflator of claim 3 wherein said second propellant charge substantially fills the space between the outer peripheral wall and the inner peripheral wall of the inflator body.

6. (previously presented) The inflator of claim 5 wherein said filter constrains said second propellant charge in said space.

7. (previously presented) An inflator for an inflatable restraint system in a vehicle comprising:

an inflator body having first and second ends and an inner peripheral wall;

a booster cup extending in said body and having an outer peripheral wall and an end surface extending inwardly from said outer peripheral wall, said booster cup having a first propellant charge positioned therein;

said inner peripheral wall and said outer peripheral wall are separated by a substantially annular space having a second propellant charge positioned therein;

an initiator assembly disposed proximate said first end and operable to ignite said first propellant charge;

a filter abutting said booster cup end surface;

a perforated disc abutting said filter; and

a nozzle positioned at said second end of said body and abutting said perforated disc, said nozzle defining a nozzle outlet for supplying an inflation gas to the inflatable restraint system.

8. (canceled) The inflator of claim 7 comprising a filter positioned adjacent said end surface.

9. (previously presented) The inflator of claim 7 wherein said body has a total length and an area defined by a cross-section thereof, and said filter has a given length about one-fourth to one-half of the total length of the body, said filter occupying a volume determined by multiplying the cross-section of said body by the length of said filter.

10. (original) The inflator of claim 7 wherein said booster cup is a substantially cylindrical elongate member substantially coaxial with said inflator body.

11. (original) The inflator of claim 10 wherein said booster cup includes a plurality of apertures formed in said outer peripheral wall.

12. (original) The inflator of claim 11 wherein said substantially annular space extends longitudinally in said inflator body from a point proximate said first end up to a point substantially coplanar with said end surface.

13. (previously presented) The inflator of claim 7 wherein said filter is substantially cylindrical and includes a substantially cylindrical periphery positioned adjacent said inner peripheral wall, and a substantially planar end positioned flush with said end surface.

14. (previously presented) An inflatable restraint system for a motor vehicle comprising:

an inflatable restraint device;

an inflator operable to provide an inflation gas to said inflatable restraint device, said inflator comprising an elongate substantially cylindrical inflator body having first and second ends and an inner peripheral wall;

an elongate booster cup mounted to said inflator body proximate said first end and extending substantially coaxially therewith, said booster cup having an outer peripheral wall separated from said inner peripheral wall by an annular space, and a plurality of apertures formed in said outer peripheral wall;

a propellant charge positioned in said space;

a filter positioned in said inflator body abutting an end portion of the booster cup , said filter securing said propellant charge in said space;

a perforated disc abutting said filter; and

a nozzle member proximate said second end of said inflator body and abutting said perforated disc, said nozzle member constraining said filter against axial displacement.

15. (original) The inflatable restraint system of claim 14 wherein said propellant charge comprises a plurality of gas generant tablets positioned in a geometrically ordered fashion in said annular space.

16. (original) The inflatable restraint system of claim 15 wherein said propellant charge comprises a plurality of gas generant tablets stacked adjacently in said annular space and having cylindrical axes oriented substantially perpendicular said inner peripheral wall.

17. (original) The inflatable restraint system of claim 14 wherein said nozzle is threadedly engaged with said inflator body.

18. (original) The inflatable restraint system of claim 14 wherein said filter is secured against said booster cup, thereby constraining said tablets from movement in said annular space.

19. (previously presented) The inflatable restraint system of claim 14 further comprising a propellant charge positioned in said booster cup.

20. (previously presented) The inflatable restraint system of claim 14 further comprising an initiator body within said inflator body proximate said first end;

wherein said booster cup is attached to said initiator body and suspended therefrom, said booster cup supported in said inflator body solely by said attachment with said initiator body.

21. (original) The inflatable restraint system of claim 14 wherein the inflatable restraint device is an airbag.

22. (original) The inflatable restraint system of claim 14 wherein the inflatable restraint device is an airbelt.

23. (currently amended) An inflatable airbelt system for a motor vehicle comprising:

an inflatable airbelt;

an inflator operable to provide an inflation gas to said airbelt, said inflator comprising an inflator body and a booster cup extending in said body, said booster cup having an outer peripheral wall and an end surface extending radially inwardly from said wall;

said booster cup includes a plurality of apertures formed in said outer peripheral wall;

a first propellant charge positioned in said booster cup;

a second propellant charge positioned in said inflator body;

an initiator assembly operable to activate said first propellant charge, wherein a combustion thereof initiates a combustion of said second propellant charge via said apertures;

a filter abutting said booster cup end surface;

a perforated disc abutting said filter; and

a nozzle positioned at an end of said inflator and abutting said perforated disc for supplying an inflation gas to the inflatable ~~restraint~~ airbelt system.

24. (original) The airbelt system of claim 23 wherein said booster cup is an elongate substantially cylindrical member oriented substantially coaxially with said inflator body.

25. (original) The airbelt system of claim 24 wherein said inflator body includes an inner peripheral wall spaced from said outer peripheral wall of said booster cup by an annular space;

said second propellant charge positioned in said space.

26. (previously presented) The airbelt system of claim 23 wherein said filter constrains said second propellant charge in said space.

27. (currently amended) An inflator module for a vehicle occupant protection system comprising:

a module housing;

an inflator positioned in said housing, said inflator comprising a booster cup mounted to [[said]] an inflator body and extending substantially coaxially therewith, said booster cup having an outer peripheral wall partially defining an annular space and a plurality of apertures formed in said outer peripheral wall;

a propellant charge positioned in said space;

a filter positioned in said inflator abutting an end portion of said booster cup for securing said propellant charge in said space;

a perforated disc abutting said filter; and

a nozzle positioned at an end of said inflator and abutting said perforated disc for supplying an inflation gas to the inflatable ~~restraint~~ vehicle occupant protection system.

28. (original) The inflator module of claim 27 wherein said inflator comprises an inflator body having an inner peripheral wall opposing said outer peripheral wall, said inner and outer peripheral walls defining said space.

29. (previously presented) The inflator module of claim 28 wherein said filter member constrains said propellant charge in said space.

30. (previously presented) A method of manufacturing a gas generator comprising the steps of:

positioning a booster cup within an elongate substantially cylindrical inflator body;

placing a propellant charge in a space extending between an outer peripheral wall of the booster cup and an inner peripheral wall of the inflator body;

inserting a filter member into the inflator body up to a point at which the filter bears against an end surface of the booster cup;

positioning a perforated disc abutting said filter; and

positioning a nozzle member in the inflator body at a selected axial position and abutting said perforated disc such that the filter is constrained from axial movement between the nozzle member and the booster cup, whereby the filter secures the propellant charge in the space.

31. (original) The method of claim 30 wherein the step of placing a propellant charge in the space comprises placing propellant tablets therein.

32. (currently amended) The method of claim 31 wherein the step of placing the propellant charge in the space comprises placing the propellant tablets therein in a geometrically ordered fashion up to a point substantially coplanar with an end surface of the ~~combustion~~ booster cup.

33. (original) The method of claim 30 wherein the filter length is sized to reduce or increase a gas pressure resulting from activation of the gas generator.

34. (original) A gas generator manufactured according to the method of claim 30.

Remarks

TELEPHONIC INTERVIEW SUMMARY

On January 12, 2007, a telephone interview was conducted with the Examiner to discuss a proposed Amendment After Final Office Action submitted to the Examiner on January 4, 2007. Responsive to the Office Communication of January 25, 2007, Applicants provide a summary of that interview. During the interview, the Examiner stated that the proposed amendments overcame the objections to claims 1, 23, 27, and 32 regarding certain informalities. However, the Examiner maintained the prior art rejections of claims 1-7 and 9-34. Thus, no agreement was reached regarding the Examiner's claim rejections based on prior art.

In the Office Action mailed on May 4, 2006, the Examiner objected to certain informalities in claims 1, 23, 27, and 32.

Claims 1, 23, 27, and 32 have been amended to address the Examiner's objections.

The Examiner also rejected claims 1-7, 9-21, and 27-34 under 35 U.S.C. 102(b) as being anticipated by Kirchoff et al., U.S. Patent No. 3,972,545.

CLAIM 1

In response, Applicants believe that claim 1 is not anticipated by Kirchoff et al. '545 because the reference does not disclose all of the elements recited in the claim. Claim 1 as amended recites:

> "1. An inflator comprising:
> an inflator body;
> a substantially cylindrical booster cup extending in said body, said booster cup having an outer peripheral wall and an end surface extending radially inwardly from said wall;
> *a plurality of apertures formed in said outer peripheral wall;*
> a first propellant charge positioned in said booster cup;
> a second propellant charge positioned in said inflator body;
> an initiator assembly *operable to activate said first propellant charge*, wherein a combustion thereof initiates a combustion of said second propellant charge and ejection of an inflation gas from said inflator body;
> a filter abutting said booster cup end surface;
> a perforated disc abutting said filter; and
> a nozzle positioned at an end of said inflator and abutting said perforated disc for supplying an inflation gas to an inflatable restraint system. "(emphasis added)

Thus, the inflator described in claim 1 includes a plurality of apertures formed in an outer peripheral the outer wall of the booster cup and, *at the same time,* an initiator assembly *operable to activate* a propellant charge. In contrast, tube 34 of the cited reference does *not* disclose an inflator including the simultaneous existence of both a plurality of apertures formed in an outer peripheral wall of a booster cup *and* an initiator assembly *operable to activate a propellant charge.*

Column 3, lines 34-48 of the reference state:

> "When the vehicle, in which the present invention is installed, collides with some other object, sensing devices, not a part of the present invention, deliver an electric signal. This signal or signals will then cause one or both electric squibs 19 and 20 to be fired. If the impact is severe, both squibs will be fired simultaneously for maximum effectiveness in delivering gases to the inflatable structure with maximum speed. However, if the impact is less severe, only the downstream squib 20 will be fired. In the latter case, combustion will proceed upstream through the partition 15 to ignite the squib 19 and the gas generant 18 in the upstream chamber 16. This provides a slower rate of inflation to provide a softer cushioning effect, but with the same quantity of gas."

Thus, in the case where both squibs 19 and 20 are fired simultaneously, the wall of tube 34 of the reference is not ruptured until *after* firing of the squibs, and until the wall is ruptured after activation of the squibs, there are no openings in the wall. However, *after* activation of the squibs and subsequent formation of any openings in tube 34, neither of the squibs is "...operable to activate the first propellant charge..." as recited in claims _, because at that point the squibs have been fired.

In the case where squibs 19 and 20 are activated sequentially, squibs 19 and 20 of the reference essentially define *two separate initiation* systems, with each initiation system configured for igniting gas generant in a corresponding one of chambers 16 and 17. As stated in column 2, lines 66-68, continuing through to column 3, line 1:

> "Each chamber 16 and 17 is further equipped with an electric squib 19 and 20, respectively, surrounded by a pyrotechnic material 21. This material 21 may also be any one of a number of compositions; but, in our preferred embodiment, comprises a granular mixture of 25% by weight of boron and 75% of potassium nitrate."

The walls of tube 34 are not ruptured until *after* firing of either squib, and until the walls are ruptured, there are no openings in the walls. However, *after* activation of a squib and subsequent formation of any resulting openings in tube 34, that squib is no longer "...operable to activate..." an associated propellant charge in an associated one of chambers 16 and 17, because at that point the squib has been fired. If the structure disclosed in Kirchoff et al. '545 did not form separate initiation mechanisms, then any activation of either of squibs 19 or 20 would result in near-simultaneous combustion of all the gas generant in *both* of chamber 16 and 17, making the phased gas deployment described above impossible.

Furthermore, the *simultaneous existence* in the inflator of the present invention of "a plurality of apertures formed in said outer peripheral wall and "an initiator assembly operable to activate said first propellant charge" is explicit, or at the very least inherent, in the language of claim 1.

In addition, the gas generator of Kirchoff et al. '545 does not disclose all of the following features recited in amended claim 1:

> "... a substantially cylindrical booster cup extending in said body, said booster cup having an outer peripheral wall *and an end surface extending radially inwardly from said wall;...*
> a filter abutting said booster cup end surface;
> a perforated disc abutting said filter; and

a nozzle positioned at an end of said inflator and abutting said perforated disc for supplying an inflation gas to an inflatable restraint system. "

The Examiner's point that a filter can include multiple components is well-taken. However, Applicants believes that the gas generator of Kirchoff et al. '545 incorporates *two separated* filters, rather than a *single* filter as disclosed in the present invention. Filtering screens 22 and coarse screen 24 forms a first filter assembly and cooling means 29 and 30 combine to form the second filter assembly. As stated in column 3, lines 9-28 of the reference, these two filters are separated by a plastic-film bag 25, containing a pH neutralizing material 26 and retained in a position adjacent a first perforated plate 23 by a second perforated plate 27. This neutralizing material 26 is *not* a filter, but rather is positioned to induce a neutralizing chemical treatment of the effluent exiting screens 24, to reduce the pH of the effluent. All effluent exiting screens 24 *must* pass through neutralizing material 26 before passing to cooling means 29 and 30 for cooling and/or further filtering. Thus, neutralizing material 26 is not a filter but rather *separates* the two filters formed by screens 22, 24 and cooling means 29, 30.

As the two filters described in the reference are separated, *neither* of the filters (screens 22, 24 or cooling means 29, 30) include all of the above-mentioned features recited in claim 1. That is, neither filter abuts both the booster cup end surface *and* a perforated disc which abuts a nozzle "positioned at an end of said inflator... for supplying an inflation gas to an inflatable restraint system "as set forth in claim 1.

For the reasons set forth above, Kirchoff et al. '545 does not disclose all of the elements recited in amended claim 1 of the present application. Thus, the rejection of claim 1 under 35 U.S.C. 102(b) as being anticipated by Kirchoff et al. '545 should be withdrawn.

CLAIM 7

In addition, the gas generator of Kirchoff et al. '545 does not disclose all of the following features recited in claim 7:

"...a booster cup extending in said body and having an outer peripheral wall and *an end surface extending inwardly from said outer peripheral wall...*
a filter abutting said booster cup end surface;
a perforated disc abutting said filter; and
a nozzle positioned at said second end of said body *and abutting said perforated disc*, said nozzle defining a nozzle outlet for supplying an inflation gas to the inflatable restraint system.

As stated previously, the Examiner's point that a filter can include multiple components is well-taken. However, also as stated previously, Applicants believes that the gas generator of Kirchoff et al. '545 incorporates *two separated* filters, rather than a *single* filter as disclosed in the present invention. Filter screens 22 and coarse screen 24 form a first filter and cooling means 29 and 30 combine to form the second filter. As stated in column 3, lines 9-28 of the reference, these two filters are separated by a plastic-film bag 25, containing a pH neutralizing material 26 and retained in a position adjacent a first perforated plate 23 by a second perforated plate 27. This neutralizing material 26 is *not* a filter, but rather is positioned to induce a chemical reaction between the effluent exiting screens 24 and the neutralizing material 26, to reduce the pH of the effluent. All effluent exiting screen 24

In addition, the gas generator of Kirchoff et al. '545 does not disclose all of the following features recited in amended claim 27. Claim 27 recites:

> "27. An inflator module for a vehicle occupant protection system comprising:
> a module housing;
> an inflator positioned in said housing, said inflator comprising a booster cup mounted to an inflator body and extending substantially coaxially therewith, said booster cup having an outer peripheral wall partially defining an annular space and a plurality of apertures formed in said outer peripheral wall;
> a propellant charge positioned in said space;
> a filter positioned in said inflator abutting an end portion of said booster cup *for securing said propellant charge in said space*;
> a perforated disc abutting said filter; and
> a nozzle positioned at an end of said inflator and abutting said perforated disc for supplying an inflation gas to the inflatable vehicle occupant protection system. "(emphasis added)

As stated previously, Applicants believes that the gas generator of Kirchoff et al. '545 incorporates *two* filters are separated by a plastic-film bag 25. As the two filters described in the reference are separated, *neither* of the filters (screens 22, 24 or cooling means 29, 30) include all of the above-mentioned features recited in claim 27. That is, neither filter secures a propellant charge in place, *and* abuts both the booster cup *and* a perforated disc which abuts a nozzle "positioned at an end of said inflator... for supplying an inflation gas to an inflatable vehicle occupant protection system " as set forth in claim 27.

For the reasons set forth above, Kirchoff et al. '545 does not disclose all of the elements recited in claim 27 of the present application. Thus, the rejection of claim 27 under 35 U.S.C. 102(b) as being anticipated by Kirchoff et al. '545 should be withdrawn.

CLAIM 30

In addition, the gas generator of Kirchoff et al. '545 does not disclose all of the following features recited in amended claim 27. Claim 30 recites:

> "30. A method of manufacturing a gas generator comprising the steps of:
> positioning a booster cup within an elongate substantially cylindrical inflator body;
> placing a propellant charge in a space extending between an outer peripheral wall of the booster cup and an inner peripheral wall of the inflator body;
> *inserting a filter member into the inflator body up to a point at which the filter bears against an end surface of the booster cup;*
> *positioning a perforated disc abutting said filter; and*
> positioning a nozzle member in the inflator body at a selected axial position *and abutting said perforated disc such that the filter is constrained from axial movement between the nozzle member and the booster cup, whereby the filter secures the propellant charge in the space.*" (emphasis added)

As stated previously, Applicants believes that the gas generator of Kirchoff et al. '545 incorporates *two* filters are separated by a plastic-film bag 25. As the two filters described in the reference are separated, *neither* of the filters (screens 22, 24 or cooling means 29, 30) include all of the above-mentioned features recited in claim 30.

must pass through neutralizing material 26 before passing to cooling means 29 and 30 for cooling and/or further filtering. Thus, neutralizing material 26 is not a filter but rather *separates* the two filters formed by screens 22, 24 and cooling means 29, 30.

As the two filters described in the reference are separated, *neither* of the filters (screens 22, 24 or cooling means 29, 30) include all of the above-mentioned features recited in claim 7. That is, neither filter abuts both the booster cup end surface *and* a perforated disc which abuts a nozzle positioned at a second end of the inflator body for supplying an inflation gas to an inflatable restraint system as described in claim 7.

For the reasons set forth above, Kirchoff et al. '545 does not disclose all of the elements recited in amended claim 7 of the present application. Thus, the rejection of claim 7 under 35 U.S.C. 102(b) as being anticipated by Kirchoff et al. '545 should be withdrawn.

CLAIM 14

In addition, the gas generator of Kirchoff et al. '545 does not disclose all of the following features recited in claim 14. Claim 14 of the present application recites:

> "14. An inflatable restraint system for a motor vehicle comprising:
> an inflatable restraint device;
> an inflator operable to provide an inflation gas to said inflatable restraint device, said inflator comprising an elongate substantially cylindrical inflator body having first and second ends and an inner peripheral wall;
> an elongate booster cup mounted to said inflator body proximate said first end and extending substantially coaxially therewith, said booster cup having an outer peripheral wall separated from said inner peripheral wall by an annular space, and a plurality of apertures formed in said outer peripheral wall;
> a propellant charge positioned in said space;
> a filter positioned in said inflator body *abutting an end portion of the booster cup , said filter securing said propellant charge in said space;*
> *a perforated disc abutting said filter; and*
> *a nozzle member proximate said second end of said inflator body and abutting said perforated disc,* said nozzle member constraining said filter against axial displacement." (emphasis added)

For the reasons set forth previously, Applicants believes that the gas generator of Kirchoff et al. '545 incorporates *two* filters are separated by a plastic-film bag 25. As the two filters described in the reference are separated, *neither* of the filters (screens 22, 24 or cooling means 29, 30) include all of the above-mentioned features recited in claim 14. That is, neither filter secures a propellant charge in place, *and* abuts both the booster cup *and* a perforated disc which abuts a nozzle member constraining the filter against axial displacement, as described in claim 14.

For the reasons set forth above, Kirchoff et al. '545 does not disclose all of the elements recited in claim 14 of the present application. Thus, the rejection of claim 14 under 35 U.S.C. 102(b) as being anticipated by Kirchoff et al. '545 should be withdrawn.

CLAIM 27

That is, neither filter secures a propellant charge in place, *and* abuts both the booster cup end surface *and* a perforated disc which abuts a nozzle member, as described in claim 30.

For the reasons set forth above, Kirchoff et al. '545 does not disclose all of the elements recited in claim 30 of the present application. Thus, the rejection of claim 30 under 35 U.S.C. 102(b) as being anticipated by Kirchoff et al. '545 should be withdrawn.

The Examiner also rejected claims 14 and 22-26 under 35 U.S.C. 103(a) as being unpatentable over Schneider et al., U.S. Patent No. 6,279,945, in view of Kirchoff et al. '545.

CLAIM 14

Claim 14 of the present application recites:

"14. An inflatable restraint system for a motor vehicle comprising:
an inflatable restraint device;
an inflator operable to provide an inflation gas to said inflatable restraint device, said inflator comprising an elongate substantially cylindrical inflator body having first and second ends and an inner peripheral wall;
an elongate booster cup mounted to said inflator body proximate said first end and extending substantially coaxially therewith, said booster cup having an outer peripheral wall separated from said inner peripheral wall by an annular space, and a plurality of apertures formed in said outer peripheral wall;
a propellant charge positioned in said space;
a filter positioned in said inflator body *abutting an end portion of the booster cup , said filter securing said propellant charge in said space;*
a perforated disc abutting said filter; and
a nozzle member proximate said second end of said inflator body and abutting said perforated disc, said nozzle member constraining said filter against axial displacement." (emphasis added)

For the reasons set forth previously, Applicants believes that the gas generator of Kirchoff et al. '545 incorporates *two* filters are separated by a plastic-film bag 25. As the two filters described in the reference are separated, *neither* of the filters (screens 22, 24 or cooling means 29, 30) include all of the above-mentioned features recited in claim 14. That is, neither filter secures a propellant charge in place, *and* abuts both the booster cup *and* a perforated disc which abuts a nozzle member constraining the filter against axial displacement, as described in claim 14.

For the reasons set forth above, Kirchoff et al. '545 does not show or suggest the above-mentioned elements recited in claim 14 of the present application. In addition, Schneider et al. '945 does not show or suggest the above-mentioned features of the present invention. Thus, even if the references were combined, no combination of the references would provide the above-mentioned features of the present invention. Therefore, the rejection of claim 14 under 35 U.S.C. 103(a) as being unpatentable over Schneider et al. '945 in view of Kirchoff et al. '545 should be withdrawn.

CLAIM 23

Claim 23 as amended recites:

"23. An inflatable airbelt system for a motor vehicle comprising:

an inflatable airbelt;

an inflator operable to provide an inflation gas to said airbelt, said inflator comprising an inflator body and a booster cup extending in said body, said booster cup having an outer peripheral wall and an end surface extending radially inwardly from said wall;

said booster cup includes a plurality of apertures formed in said outer peripheral wall;

a first propellant charge positioned in said booster cup;

a second propellant charge positioned in said inflator body;

an initiator assembly *operable to activate said first propellant charge*, wherein a combustion thereof initiates a combustion of said second propellant charge via said apertures;

a filter abutting said booster cup end surface;

a perforated disc abutting said filter; and

a nozzle positioned at an end of said inflator and abutting said perforated disc for supplying an inflation gas to the inflatable airbelt system." (emphasis added)

Thus, the inflator described in claim 23 includes a plurality of apertures formed in an outer peripheral the outer wall of the booster cup and, *at the same time,* an initiator assembly *operable to activate* a propellant charge. In contrast, tube 34 of the cited reference does *not* disclose an inflator including the simultaneous existence of both a plurality of apertures formed in an outer peripheral wall of a booster cup *and* an initiator assembly *operable to activate a propellant charge.*

Column 3, lines 34-48 of the reference state:

"When the vehicle, in which the present invention is installed, collides with some other object, sensing devices, not a part of the present invention, deliver an electric signal. This signal or signals will then cause one or both electric squibs 19 and 20 to be fired. If the impact is severe, both squibs will be fired simultaneously for maximum effectiveness in delivering gases to the inflatable structure with maximum speed. However, if the impact is less severe, only the downstream squib 20 will be fired. In the latter case, combustion will proceed upstream through the partition 15 to ignite the squib 19 and the gas generant 18 in the upstream chamber 16. This provides a slower rate of inflation to provide a softer cushioning effect, but with the same quantity of gas."

Thus, in the case where both squibs 19 and 20 are fired simultaneously, the wall of tube 34 of the reference is not ruptured until *after* firing of the squibs, and until the wall is ruptured after activation of the squibs, there are no openings in the wall. However, *after* activation of the squibs and subsequent formation of any openings in tube 34, neither of the squibs is "...operable to activate the first propellant charge..." as recited in claim 23, because at that point the squibs have been fired.

In the case where squibs 19 and 20 are activated sequentially, squibs 19 and 20 of the reference essentially define *two separate initiation* systems, with each initiation system configured for a igniting gas generant in a corresponding one of chambers 16 and 17. As stated in column 2, lines 66-68, continuing through to column 3, line 1:

"Each chamber 16 and 17 is further equipped with an electric squib 19 and 20, respectively, surrounded by a pyrotechnic material 21. This material 21 may also be any one of a number of compositions; but, in our preferred embodiment, comprises a granular mixture of 25% by weight of boron and 75% of potassium nitrate."

The walls of tube 34 are not ruptured until *after* firing of either squib, and until the walls are ruptured, there are no openings in the walls. However, *after* activation of a squib and subsequent formation of any resulting

openings in tube 34, that squib is no longer "...operable to activate..." an associated propellant charge in an associated one of chambers 16 and 17, because at that point the squib has been fired. If the structure disclosed in Kirchoff et al. '545 did not form separate initiation mechanisms, then any activation of either of squibs 19 or 20 would result in near-simultaneous combustion of all the gas generant in *both* of chamber 16 and 17, making the phased gas deployment described above impossible.

Furthermore, the *simultaneous existence* in the inflator of the present invention of "a plurality of apertures formed in said outer peripheral wall and "an initiator assembly operable to activate said first propellant charge" is explicit, or at the very least inherent, in the language of claim 23.

For the reasons set forth above, Kirchoff et al. '545 does not show or suggest an inflator having a booster cup "...including a plurality of apertures formed in said outer peripheral wall..." and "...an initiator assembly operable to activate said first propellant charge..." as recited in claim 23. In addition, Schneider et al. '945 does not show or suggest the above-mentioned features of the present invention. Thus, even if the references were combined, no combination of the references would provide the above-mentioned features of the present invention. Therefore, the rejection of claim 23 under 35 U.S.C. 103(a) as being unpatentable over Schneider et al. '945 in view of Kirchoff et al. '545 should be withdrawn.

In addition, claim 23 as amended recites:

> "23. An inflatable airbelt system for a motor vehicle comprising:
> an inflatable airbelt;
> an inflator operable to provide an inflation gas to said airbelt, said inflator comprising an inflator body and a booster cup extending in said body, said booster cup having an outer peripheral wall and *an end surface extending radially inwardly from said wall*;
> said booster cup includes a plurality of apertures formed in said outer peripheral wall;
> a first propellant charge positioned in said booster cup;
> a second propellant charge positioned in said inflator body;
> an initiator assembly operable to activate said first propellant charge, wherein a combustion thereof initiates a combustion of said second propellant charge via said apertures;
> *a filter abutting said booster cup end surface;*
> *a perforated disc abutting said filter; and*
> *a nozzle positioned at an end of said inflator and abutting said perforated disc for supplying an inflation gas to the inflatable airbelt system.*" (emphasis added)

For the reasons set forth previously, Applicants believes that the gas generator of Kirchoff et al. '545 incorporates two filters are separated by a plastic-film bag 25. As the two filters described in the reference are separated, neither of the filters (screen 22, 24 or cooling means 29, 30) include all of the above-mentioned features recited in claim 23. That is, neither filter abuts *both* the booster cup and a perforated disc which abuts a nozzle "positioned at an end of said inflator and abutting said perforated disc for supplying an inflation gas to the inflatable airbelt system ..." as described in claim 23. In addition, Schneider et al. '945 does not show or suggest the above-mentioned features of the present invention. Thus, even if the references were combined, no combination of the references would provide the above-mentioned features of the present invention. Therefore, the rejection of claim

23 under 35 U.S.C. 103(a) as being unpatentable over Schneider et al. '945 in view of Kirchoff et al. '545 should be withdrawn.

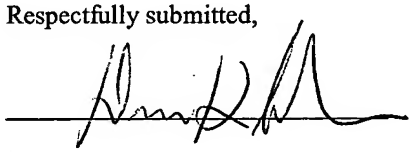
The inflator of the present invention provides important advantages over the devices disclosed in the cited references. The dimensions of the apertures formed the booster cup of the present invention are predetermined and permanent, facilitating more predictable flow of combustion products from the booster cup and combustion of the gas generant. This provides an inherently safer design. The pre-existing apertures formed in the booster cup also facilitate more rapid ignition of the gas generant; there is no delay in the transfer of combustion products from the booster cup to the gas generant due to the need to rupture the tube to create apertures. The present invention also utilizes a single filter rather than multiple filters, making it simpler, less costly, more compact, and easier to manufacture than the devices disclosed in the cited references. The added compactness of the present design makes it suitable for use in a wider variety of applications such as, for example, an airbelt.

Applicants submit that, as claim 1 is deemed patentable, claims 2-6 are also patentable as they depend from claim 1. Also, as claim 7 is deemed patentable, claims 9-13 are also patentable as they depend from claim 7. Also, as claim 14 is deemed patentable, claims 15-22 are also patentable as they depend from claim 14. Also, as claim 23 is deemed patentable, claims 24-26 are also patentable as they depend from claim 23. Also, as claim 27 is deemed patentable, claims 28-29 are also patentable as they depend from claim 27. Also, as claim 30 is deemed patentable, claims 31-34 are also patentable as they depend from claim 30.

In view of the above amendments and remarks, the Applicants respectfully submit that all rejections of record have been overcome. The Applicants respectfully requests favorable reconsideration and allowance of the present application.

Submitted herewith is a credit card authorization sheet to charge the amount of $120 to cover the cost of the one-month extension. The Commissioner is authorized to charge any deficiencies related to this paper to deposit account no. 50-3238.

Respectfully submitted,



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Dated: February 15, 2007

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Appendix G

Examiner's Advisory Action (paper no. 200701226) mailed January 25, 2007

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/826,437	04/16/2004	Eduardo L. Quioc	5702-01051	1043

7590 01/25/2007

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EXAMINER
ROSENBERG, LAURA B

ART UNIT	PAPER NUMBER
3616	

MAIL DATE	DELIVERY MODE
01/25/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

1 1-29 1-16
2 DKT 1-MONTH
EXT 2-16

3 KS

Advisory Action Before the Filing of an Appeal Brief	Application No. 10/826,437	Applicant(s) QUIOC ET AL.	
	Examiner Laura B. Freedman	Art Unit 3616	

--The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

THE REPLY FILED 04 January 2007 FAILS TO PLACE THIS APPLICATION IN CONDITION FOR ALLOWANCE.

1. ☒ The reply was filed after a final rejection, but prior to or on the same day as filing a Notice of Appeal. To avoid abandonment of this application, applicant must timely file one of the following replies: (1) an amendment, affidavit, or other evidence, which places the application in condition for allowance; (2) a Notice of Appeal (with appeal fee) in compliance with 37 CFR 41.31; or (3) a Request for Continued Examination (RCE) in compliance with 37 CFR 1.114. The reply must be filed within one of the following time periods:
   a) ☒ The period for reply expires 3 months from the mailing date of the final rejection.
   b) ☐ The period for reply expires on: (1) the mailing date of this Advisory Action, or (2) the date set forth in the final rejection, whichever is later. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of the final rejection.

   Examiner Note: If box 1 is checked, check either box (a) or (b). ONLY CHECK BOX (b) WHEN THE FIRST REPLY WAS FILED WITHIN TWO MONTHS OF THE FINAL REJECTION. See MPEP 706.07(f).

Extensions of time may be obtained under 37 CFR 1.136(a). The date on which the petition under 37 CFR 1.136(a) and the appropriate extension fee have been filed is the date for purposes of determining the period of extension and the corresponding amount of the fee. The appropriate extension fee under 37 CFR 1.17(a) is calculated from: (1) the expiration date of the shortened statutory period for reply originally set in the final Office action; or (2) as set forth in (b) above, if checked. Any reply received by the Office later than three months after the mailing date of the final rejection, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

NOTICE OF APPEAL

2. ☐ The Notice of Appeal was filed on _____. A brief in compliance with 37 CFR 41.37 must be filed within two months of the date of filing the Notice of Appeal (37 CFR 41.37(a)), or any extension thereof (37 CFR 41.37(e)), to avoid dismissal of the appeal. Since a Notice of Appeal has been filed, any reply must be filed within the time period set forth in 37 CFR 41.37(a).

AMENDMENTS

3. ☐ The proposed amendment(s) filed after a final rejection, but prior to the date of filing a brief, will not be entered because
   (a) ☐ They raise new issues that would require further consideration and/or search (see NOTE below);
   (b) ☐ They raise the issue of new matter (see NOTE below);
   (c) ☐ They are not deemed to place the application in better form for appeal by materially reducing or simplifying the issues for appeal; and/or
   (d) ☐ They present additional claims without canceling a corresponding number of finally rejected claims.

   NOTE: _____. (See 37 CFR 1.116 and 41.33(a)).
4. ☐ The amendments are not in compliance with 37 CFR 1.121. See attached Notice of Non-Compliant Amendment (PTOL-324).
5. ☒ Applicant's reply has overcome the following rejection(s): Claim objections for claims 1, 23, 27, and 32.
6. ☐ Newly proposed or amended claim(s) _____ would be allowable if submitted in a separate, timely filed amendment canceling the non-allowable claim(s).
7. ☒ For purposes of appeal, the proposed amendment(s): a) ☐ will not be entered, or b) ☒ will be entered and an explanation of how the new or amended claims would be rejected is provided below or appended.

   The status of the claim(s) is (or will be) as follows:
   Claim(s) allowed: _____.
   Claim(s) objected to: _____.
   Claim(s) rejected: *1-7 and 9-34*.
   Claim(s) withdrawn from consideration: _____.

AFFIDAVIT OR OTHER EVIDENCE

8. ☐ The affidavit or other evidence filed after a final action, but before or on the date of filing a Notice of Appeal will not be entered because applicant failed to provide a showing of good and sufficient reasons why the affidavit or other evidence is necessary and was not earlier presented. See 37 CFR 1.116(e).
9. ☐ The affidavit or other evidence filed after the date of filing a Notice of Appeal, but prior to the date of filing a brief, will not be entered because the affidavit or other evidence failed to overcome all rejections under appeal and/or appellant fails to provide a showing a good and sufficient reasons why it is necessary and was not earlier presented. See 37 CFR 41.33(d)(1).
10. ☐ The affidavit or other evidence is entered. An explanation of the status of the claims after entry is below or attached.

REQUEST FOR RECONSIDERATION/OTHER

11. ☒ The request for reconsideration has been considered but does NOT place the application in condition for allowance because: See Continuation Sheet.
12. ☐ Note the attached Information Disclosure Statement(s). (PTO/SB/08) Paper No(s). _____
13. ☐ Other: _____.

1/23/07

PAUL N. DICKSON
SUPERVISORY PATENT EXAMINER
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Laura B. Freedman

Continuation of 11. does NOT place the application in condition for allowance because: Examiner maintains the prior art rejections for claims 1-7 and 9-34, as set forth in the final office action.

With respect to claim 1 and the plurality of apertures formed in the outer peripheral wall of the booster cup, the claim does not specify the exact time that the apertures are evident in the wall. Thus, the Kirchoff et al. reference, with apertures formed in the wall subsequent to generator activation, reads on the claim. Further, Kirchoff et al. disclose a filter (including #22, 24, 28, 29, 30, 32) abutting the booster cup end surface (in particular, filter component #22 abutting right end of booster cup), a perforated disc (including #31, 33) abutting the filter (abutting right end of filter), and a nozzle (including #12) positioned at an end of the inflator and abutting the perforated disc (best seen in figure) and able to supply an inflation gas to an inflatable restraint system, as set forth in the final office action. Based on applicant's arguments, it appears that applicant does not consider a filter to be a feature that can include multiple components. However, in the Kirchoff et al. reference, the filter does indeed include multiple components (including #22, 24, 28, 29, 30, 32).

With respect to claim 9, the portion of the MPEP § 2125 cited in the Response to Arguments section of the final office action sets forth that when the specification is silent on the issue of specific proportions, dimensions, and scale of drawings, "the description of the article pictured can be relied on, in combination with the drawings, for what they would reasonably teach one of ordinary skill in the art". Thus, while Kirchoff et al. is silent with respect to specific dimensions and scale of the drawing, the description and drawing can still be relied on for what they would reasonably teach one of ordinary skill in the art, including the filter length being about one-fourth to one-half of the total length of the inflator body.